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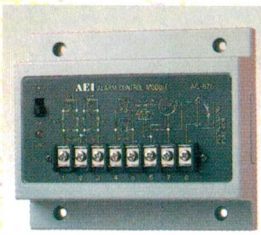

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L 5820

$649

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For use as an additional PIR detector for the 2-zone Micromark alarm system (L-5180). NOTE: Only one additional PIR detector can be added to this system.

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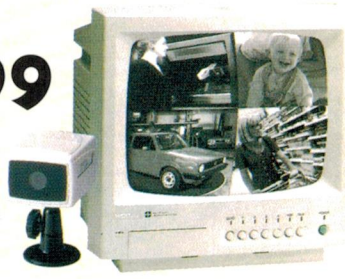

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World of Electronics

Projects and Technical

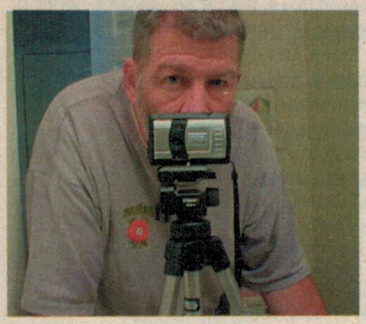
Columns and Comments

Departments

On the cover

David Jones' new Mk3 DSO Adaptor effectively turns your PC into a two channel 10MHz sampling scope, for much less than you'd pay for a similar commercial scope (see p.44). Rob Evans' new project lets you control your complete audio system with the VCR or CD player's remote (p.58). Photos by Phil Aynsley, Michael Pugh.

Tom's new digital baby



14 ***Tom Moffat is rapt in his new Epson PhotoPC 550 camera, and it isn't even their latest megapixel marvel...***

Clearance specials...

26 ***For experimenters, Allthings Sales offers quite a few low-cost goodies***

Improving car safety

20 ***Ross Bannatyne's informative story on how electronics is improving car safety concludes in this issue...***

Professional Electronics

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Letters to the Editor

Colour blindness

As an electronics technician I occasionally come across the issue of 'colour blindness', but have not seen it mentioned in the magazine for a very long time.

Apparently some 12% of males suffer from the condition while the figure is only about 1% for females. Industry carefully screens both sexes before employing them in areas where making colour recognition errors would cause safety or work performance problems. There are various colour vision defects and perhaps an expert in this field could advise readers on the errors made by persons with each of these.

My concern is that anyone can take up being an electronics repairman or purchase a kit of parts to assemble. I have never seen a warning regarding colour recognition in relation to kits, and this would appear to be a major omission. The widespread use of often ambiguous 1% four-band resistors has led many kit constructors to measure each one with a DMM, but others don't bother or have no meter available.

Might I suggest that males experiencing any difficulty identifying colours accurately approach a sympathetic member of the opposite sex, to verify their presumptions about resistor codes and other colour related matters when assembling kits. I would prefer this be done before condemning the kit supplier or designer, and do hope that the prospect is not too confronting to male egos!

Phil Allison, Sydney NSW

Memory chips

I like to assemble old computers in my spare time, so when I saw your PC for $100 article I naturally read it straight away. However while reading I noticed there was a mistake regarding memory. The author suggested you get 2MB of memory. To achieve this he stated that you would buy two 1 meg chips. This is incorrect because 30-pin SIMMs are inserted in groups of four (with the exception of some brand name boards). If one of the future builders took his advice the computer would not work! He also stated that a hard drive was not a necessity. This is true but I thought that some of your readers would like to know that you can pick up a 40MB hard disk at a swap meet for $5.

Jarrad Mitchell (via e-mail)

Comment: Robert Gott was probably referring to the older DIL memory chips rather than SIMMs, Jarrad. But thanks for the feedback.

Irresponsible!

I am concerned at the boxed section of 'things not to do...' on p27 of August 98' EA. Yes, it is amusing to ponder the peculiarities of some operating systems and their ability to self destruct, but this shouldn't be spread to an open audience. There are many PCs in public places now and I know that my wife, who works in a secondary school library, will very likely be the victim of some of the 'tricks' detailed.

Please castigate/counsel Mr Cattley! You have a position of editorial (in the literal sense) responsibility to the community, as well as your readers.

Graham Goeby (via e-mail)

Vegatest machines

With regard to Chris Johnson-Walker's correspondence published in the August 1998 *EA*, the 'Vegatest' machines, made by the Grieshaber Group in Germany, are indeed a popular line of electrodiagnostic flummery boxes.

Check out **http://www.quackwatch.-com/01QuackeryRelatedTopics/electro.html** on the excellent Quackwatch site for more information.

Daniel Rutter (via e-mail).

Why we aren't...

Congratulations on raising the issue of why are we not doing it here, as raised in your editorial in the July issue. It has always puzzled me as to why we let our technology based industries run down, and also why we seem more concerned with selling our resources than using them and value adding.

One non-electronic example: it was only in the last month that the approval was given for the first Australian aircraft engine since WW2. This is a gap of about 50 years. I could go on and on with many examples, but that would produce a large list.

It appears to me that we have now and have had for some time, people without

national interest at all in the decision making levels of industry and government. To complicate matters young people are deserting the education needed to have a good technology base in this country. Further, we have a decreasing amount of fundamental research in the physical sciences.

To make matters worse, we are closing the very university departments needed to support technology. It appears as if 'parasite' professions, those which do not generate fundamental wealth themselves, are more attractive. A country can only support these professions and others like them by having a substantial production base. Have the 'economic irrationalists' missed this basic point?

By the way I have been involved in electronics since I was nine years old. I am tertiary educated in physics, education, and information technology. I am young enough to have purchased *Radio and Hobbies*. Keep stirring!

Ron Smith VK4AGS, Calliope Qld

That odd 1925 circuit

I would like to point out an error in the Vintage Radio article in the July issue. Roger Johnson's criticism of the 'Listener In' 1925 circuit missed the point that the A- line is not connected to the earthed aerial coil and as a battery set the entire set 'floats' with respect to earth. Therefore the AF signal can be developed across C8; in effect the grid is grounded and the entire rest of the set has the detected AF impressed on it.

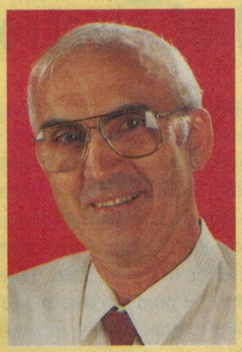
The circuit would look more usual if the A- was earthed and indeed the set would still work. However as drawn any static, etc. which is picked up by the aerial is shunted to ground and not fed straight into the grid.

I always enjoy the wealth of information in your magazine and I hope this will be seen as constructive discussion, not nitpicking. Please keep up the good work.

Don Black, Cockatoo, Vic. ❖

Letters published in this column express the opinions of the correspondents concerned, and do not necessarily reflect the opinions or policies of the staff or publisher of Electronics Australia. We welcome contributions to this column, but reserve the right to edit letters which are very long or potentially defamatory.

Editorial Viewpoint



Wideband data comms: clearing the bottleneck is taking a little longer

IN MANY AREAS of electronics, and especially in data processing and communications, the developments continue to come at an ever-faster rate. If you bought a personal computer three months ago, it's already obsolete in the technical sense. Much the same applies to a digital camera, or a CD player, or a VCR. (They can still be quite useful, of course, and will continue to be so for some time.)

But one area where things have been moving rather more slowly — in the practical sense — is in what we might call 'domestic and SOHO data communications'. So much so that for many of us, our day to day interaction via and with the Internet and Web is beginning to be quite significantly degraded, even in our major cities and suburbs.

It must be over five years since we first began running stories in *EA* about low cost ISDN links, or dramatically faster data communications via DSL (digital subscriber line) technology, or cable modems or optical fibre links. And it's almost as long since the cables for hybrid-fibre-coax or 'HFC' wideband networks were deployed past millions of Australian homes. Yet the vast majority of us are still struggling with fairly clunky 28.8kb/s or 33.6kb/s modem links over standard 'POTS' (plain old telephone service) lines. Or if we're really optimistic, we might be using a 57.6kb/s modem...

The reality is that one way or another, none of the new wideband communications technologies has become available to most of us as yet, and if anything they seem to be receding into the distance rather than galloping toward us. In Australia the real cost of ISDN has never dropped to the level where it could become an attractive proposition for private users, while the HFC cable networks seem to have struck many difficulties (both technical and economic) in providing effective high speed data services over their cables. It's also gradually become clearer that on each HFC cable drop, the effective bandwidth and speed for each data comms user falls significantly as more users come on line — because they're all effectively sharing a single RF channel.

Even DSL technology, with its promise of wideband links via existing exchange-subscriber copper wiring, seems to be proceeding at a crawl — and every time there's any news, the realisable bandwidth seems to have dropped again. So one way or another, most of us are likely to be relying on our trusty modems for some time yet...

Ironic, isn't it? Our computers have become fast enough to process digital video and audio in real time, at a cost that's steadily falling, but our telecommunications services are lagging further and further behind — and in an era when they've supposedly been opened up to competition, too.

I can only assume that it all boils down to economics. Presumably the telecomms service providers either don't have the money, or aren't convinced that it would be sufficiently profitable, to invest in a serious roll-out of wideband communications for any but their big corporate customers.

The investors in and shareholders of the new (and not-so-new, but now semi-privatised) telecomm service providers are presumably happy, with their financial returns. But we customers seem to be losing out, in terms of up to date communications options.

Jim Rowe

WHAT'S new

in the ever-changing world of electronics

Not a colour copier, a 'colour imaging system'

Anticipating dramatic growth in the SOHO market, **Panasonic** has launched its Digital Colour Imaging System (DCIS) KX-PS8000 — a colour printer, colour scanner and colour duplicator in one compact unit. It's the first of the company's new 'Monet' series of colour imaging products, and can be connected to an office network using the optional network card.

As a colour laser printer it produces 1200 x 1200dpi high resolution full-colour documents, prints at 14ppm in monochrome and 3.5ppm in full-colour printing at 600dpi, or 7ppm in mono and 1.75ppm in colour at 1200 dpi. It comes standard with 16MB of RAM, which is expandable to 80MB.

The scanner is a one-pass flatbed, scanning at 600dpi optical up to a maximum of 9600dpi through software interpolation. It scans an A4 page in 7.8 seconds at 300dpi.

The KX-PS8000 DCIS is also a stand-alone full colour duplicator. It duplicates at 3.5ppm in colour and 14ppm in monochrome on A4, Letter or Legal size. If any adjustments need to be made to the image, a novel Digital Duplicator Utility provides several options for image editing.

The Panasonic KX-PS8000 is available from selected Panasonic Authorised Business Centres for an RRP of $18,200 including tax ($14,900 ex tax). For more information circle **143** on the reader service card or contact Panasonic's Customer Care Centre on 132 600.

Surge & spike stopper

Even small home offices have quite a lot of electronic equipment nowadays — computers, fax machines, copiers etc — and many of them can suffer expensive damage from surges and spikes on the power or phone lines, due to things like electrical storms. Happily power surge protection is now readily available at very reasonable cost, with a new range of surge protectors developed and made in Australia by HPM.

The **HPM** Computer Protector (Cat. D105PP4RJ, RRP $60) and Teleguard (Cat. D105PA4RJ, RRP $50) are claimed to differ from others on the market by using advanced technology. The new Computer

Protector is said to be superior to any other product currently on the market.

The surgeboards plug into any powerpoint and feature four power outlets (six outlets available shortly) with overload protection. A novel addition is the two surge protected phone sockets on the board, providing protection to both incoming power and incoming data. A safety neon light is also inbuilt to indicate if the surge protection is no longer available.

They're available through Mitre 10, Bunnings WA and all major hardware stores.

Digital Tuner, Amp from Harman Kardon

Harman Kardon has now introduced to the Australian market its new US-designed Signature Series Model 2.0 Dolby Digital Processor/Tuner, Model 2.1 Multichannel Amplifier and Model 1.5 Two-Channel Bridgeable Power Amplifier.

As well as conventional analog inputs, the Model 2.0 is fully compatible with all Dolby Digital (AC-3) sources; up to six separate digital inputs can be connected, via four coaxial and two optical inputs. Conventional 'stereo' digital outputs from CD and LV players can also be decoded. The 2.0 delivers five full-range discrete outputs for Dolby Digital, along with the separate LFE channel for the sub-woofer. For analog sources it can decode regular Dolby Pro Logic as well as provide 10 different music and 'movie' DSP modes.

Also included in the Model 2.0 is an AM/FM stereo tuner, with RDS tuning and 30 memory presets. The Processor/Tuner has an RRP of $4395.

The companion Model 2.1 Power Amplifier provides five channels of power amplification and combines ultrawide bandwidth with high current output. Each channel is rated at 100W into 8 ohms and 150W into 4 ohms (THD below 0.03%), with a current capability of more than +/-100A. Frequency response is 1Hz - 170kHz +/-13dB, with a power bandwidth of 5Hz - 160kHz (+/-3dB) and a signal to noise ratio in excess of 115dB at rated power.

The Model 2.1 has an RRP of $2995.

For more information circle **148** on the reader service card or contact distributor Convoy International, 1801 Botany Road, Botany 2019.

First megapixel camera from Epson

Epson has announced its first megapixel digital camera, the EPSON PhotoPC 700. Capturing over 1.25 million pixels per image (1280 x 960), the new model also offers a continuous-shoot function that lets users capture two images per second, and a direct-print function whereby images can be printed, up to A4 in size, via a range of Epson Stylus inkjet printers.

The PhotoPC 700 is an auto-focus camera which uses advanced image processing and enhancement algorithms, plus Epson's ColorTrue in-camera processing system to ensure each picture captured has accurate colour definition, balance and contrast. It offers a choice between auto exposure and manual exposure, and also between Auto White Balance and Fixed White Balance.

The camera features a 50mm active matrix

colour LCD monitor and comes with 4MB of internal memory. This means users can capture up to 40 standard, 12 Fine or six SuperFine resolution images. It also supports optional removable and reusable CompactFlash storage cards. When inserted into PCMCIA adapters, CompactFlash cards can be quickly and easily read using any notebook or desktop computer with a PCMCIA reader.

The power supply is said to provide 1.5 times the battery life of the PhotoPC 600. This is due to a new, improved power supply and faster processing time of recorded images. An optional NiMH Power Pak is available.

For greater display versatility, the PhotoPC 700 also provides a video output signal compatible with any TV, VCR or multimedia projector. It carries an RRP of $1299.

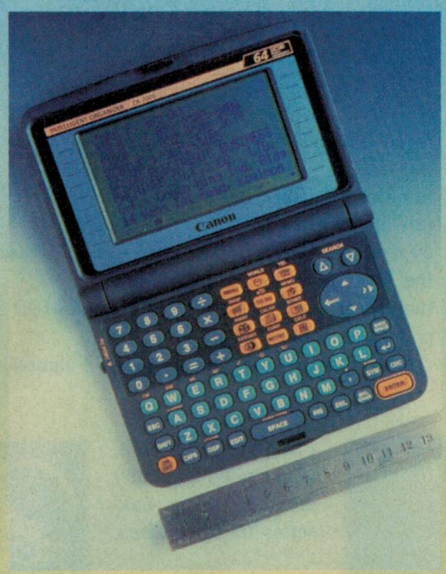
For more information circle **147** on the reader service card or contact Epson Australia, 70 Gibbes Street, Chatswood 2067.

Compact 'organisers' feature links to PCs

Canon has expanded its range of pocket-sized Intelligent Organisers with five new optionally PC-linkable models, claimed to bring new functionality and meaning to 'organisation'.

The compact and low cost ZX5000 and ZX5100 are simple to use yet sophisticated enough for everyday business needs, while small enough for a coat pocket or purse. Users can store up to 2408 names and numbers on the ZX5000 and 4076 on the ZX5100. The two models offer 66KB and 130KB memory respectively and feature an extra large LCD screen with 16 x 5 characters and a graphic icon display. The inbuilt password protection function (also shared by the ZX7000, ZX7100 and ZX7200) allows users to keep private information confidential and accessible by setting the password.

On the ZX7000, ZX7100 and ZX7200 up to 2000, 4000 and 6000 names and addresses can be stored on each model respectively, with 64KB, 128KB and



256KB of memory.

The ZX5000 and ZX5100 feature a QWERTY keyboard and unit-to-unit Infrared Data transmission (IrDA). The ZX7000/7100/7200 feature a zoom function which allows users to zoom in from an eight-line small character display to a four-line large character display. Included are five inbuilt languages so users can select from English, French, German, Spanish and Italian prompts. There is a metric conversion mode for 15 metric conversions and also 12 pre-defined currency conversions.

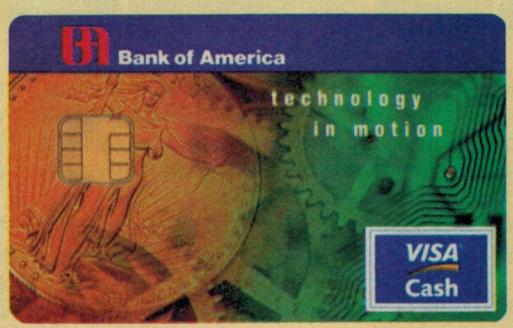
All new ZX family models feature an optional PC Link Kit. The ZX-PL1 link can connect the organiser to an IBM compatible computer to check, update, edit or print data providing security back-up.

The Canon ZX Series of Intelligent Organisers are available from Canon dealers and selected retail stores. Prices range from $99.95 for the ZX5000 to $199 for the ZX7200, with the ZX-PL1 PC Link Option priced at $49.95.

For more information circle **145** on the reader service card or contact Canon Australia, 1 Thomas Holt Drive, North Ryde 2113.

Smart cash card can be 'refilled' via home PC

After lagging behind various European and Asian countries in their use of stored-value smart cards, the USA now seems to be streaking ahead. **Bank of America** is now running a pilot program involving several hundred BoA and Visa employees, using Visa Cash cards into which funds can be transferred from the user's cheque account via the Internet and a home PC, using a secure browser.



The card is connected to the PC by fitting it into a special adaptor which is inserted into a standard 3.5" floppy disk drive. A home or office PC is thus transformed into a 'personal ATM', allowing the card to be topped up at any time without the customer having to leave the home or office.

WHAT'S new in the ever-changing world of electronics

New digital cellphone from Panasonic

Panasonic's new G600 digital mobile phone is aimed at the executive and professional market. It's small and slim with a large screen capable of displaying three lines of text and two lines of icons — to keep the user aware of battery life, network reception, call diversions, Vibration Alert, messages and menu options. It also weighs only 129 grams with the standard battery and gives up to three hours talktime and 80 hours stand-by time.

The G600 also includes Panasonic's 'Voice Memo' function, which allows the user to record up to 50 seconds of two-way conversation to play back after the call. This is particularly useful for recording a phone number or address to be recalled later.

'Vibration Alert' is built into the G600 and can be easily activated by holding down one key. Once enabled, the phone will automatically vibrate when a call is received, rather than ring. It can also be set to vibrate and ring at the same time if required.

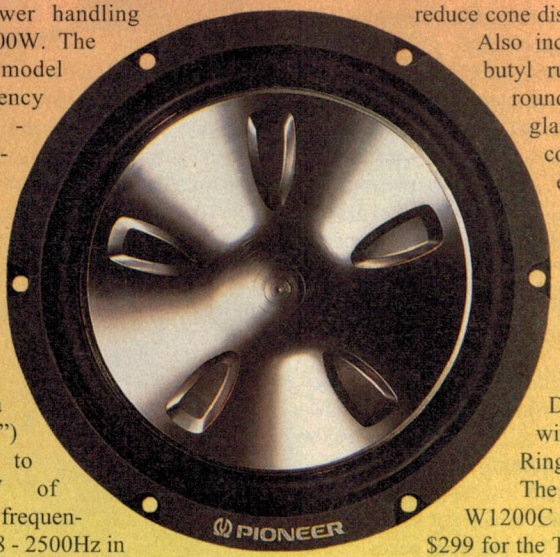
The G600 comes standard with a lithium ion battery, which is extremely light and does not suffer from memory effect. The phone is also data compatible, allowing users to send/receive SMS messages or faxes, as well as access the Internet, when used with a PCMCIA data card.

For further information contact Panasonic's Customer Care Centre on 132 600.

Rugged car subwoofers

To emphasis their rugged construction, **Pioneer** has dubbed its new car subwoofer drivers the 'Bass Bullet' series. The TS-W1200C and TS-W1000C were designed to play in a small, sealed enclosure with high power handling capabilities, but can also be supplied in an infinite baffle form (for mounting behind the rear seat, for example).

The TS-W1200C measures 30cm (12") and has a power handling capability of 800W. The 'C' (cabinet) model has a frequency response of 15 - 2000Hz and sensitivity of 92dB, while the 'F' (infinite baffle) version ranges from 18Hz with a sensitivity of 93dB. The TS-W1000C is a mere 25cm (10") but is claimed to handle 600W of power. Its rated frequency response is 18 - 2500Hz in the 'C' model and 20 - 2500Hz in the 'F' version, with a sensitivity of 91dB and 92dB respectively.



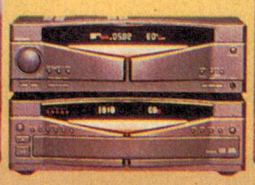
Both drivers use nickel-coated Foamed IMPP (Injection-Molded Polypropylene) composite cones, claimed to stand up to continuous high decibel output. The one-piece seamless Bass Bullet cone construction, with no dust cap, enables far better cone response control than previously possible. The integrated conical domes (Bass Bullets) appear as protrusions on the cone surfaces. Their size, shape and number was selected to increase cone rigidity and reduce cone distortion.

Also incorporated are a butyl rubber edge surround, large diameter glass-imide voice coil bobbin, vented and projected pole yoke design, gold-plated binding posts, a large strontium magnet, and (on the 'F' models) a Double Damper with Dual Damper Ring.

The RRP for the TS-W1200C is $399, and $299 for the TS-W1000C. For more information circle **144** on the reader service card or contact Pioneer Electronics Australia, 178-184 Boundary Road, Braeside 3195.

Stylish AV system

To ensure that the styling of its new R315R Series 21 audio-visual component system matched the performance, **Kenwood** enlisted leading Italian designer Giorgetto Giugiaro for its design. The result is claimed to push the frontiers of digital audio performance and also create new standards in system design.



The new 'baby' of company's Series 21 systems, the R315R system itself is made up of 70W/channel receiver, multiple CD player and surround speakers, with the capability of expansion by adding other components.

The R-V300 A/V Receiver offers Dolby Pro Logic which, when playing Dolby encoded video cassettes or laser discs, combines with Dolby 3 Stereo to recreate cinema atmosphere and surround sound realism. A three-mode DSP provides a choice of ambience settings for your listening enjoyment — Arena, Jazz Club, Stadium, or Theatre. Complementing the receiver is the D-R350 Multiple CD player, a five-disc unit featuring Kenwood's DRIVE (dynamic resolution intensive vector enhancement) system.

The R315R comes with the S-F100 front speaker system and the S-CRS500 Centre/Surround Speaker Package System. The S-F100 is a front two-way three speaker system of 100W maximum input power, twin 130mm woofers, and a 35mm tweeter, identical to the centre portion of the S-CRS500. The rear surround system includes a full range dipole speaker system capable of 100W of max power.

The Series 21 R315R has an RRP of $1699 and is covered by a two year parts and labour warranty. For more information circle **146** on the reader service card or contact Kenwood Electronics Australia.

'5-D' home theatre system from Pioneer

Pioneer's new VSX-D5065 and VSX-536S audio/video receivers are claimed to enhance home theatre systems based on analog Dolby Pro Logic sound decoding, by adding stereo information to the rear channels, using Pioneer's '5-D Theatre' system.

With normal Dolby Surround, the two rear speakers receive only mono information and can produce only identical sound at identical levels. For the 5-D Theatre system Pioneer has developed a circuit to correlate information received by both front and back channels, so that the rear channel information follows that of the front channels. Although the sound from the rear channels is still mono, the output levels change independently to correspond with those of the front channels.

The VSX-D506S and VSX-536S also include Pioneer's Sound Field Control (SFC) feature, whereby a Digital Signal Processor (DSP) provides a choice of four different surround field control modes. You can simulate the cozy atmosphere of a small jazz club, the impressive acoustics of a sound studio, the open space of an arena, or the excitement of a large concert hall.

The VSX-D506S boasts a power output of 100W RMS on all channels in all modes, while the VSX-536S delivers 65W on all channels in stereo (60W in surround mode). The VSX-D506S has an RRP of $999, and the VSX-536S an RRP of $899. For more information circle **141** on the reader service card or contact Pioneer Electronics Australia, 178-184 Boundary Road, Braeside 3195.

New digital cameras from Panasonic

Panasonic's two new digital still cameras, the NV-DCF3 (VGA) and NV-DCF5 (XGA) are extremely compact. The DCF3 is already available and the DCF5 will be available shortly.

Both models use a CF (compact flash) memory card to store the digital images. When one card is full, pictures can be downloaded to a computer or a new memory card can be inserted. Images can also be downloaded directly to a PC and edited. The DCF3 comes with a 2MB (two megabyte) card and the DCF5 with an 8MB card.

The more advanced DCF5 provides images in XGA format (1024 x 768 pixels) with a progressive scan CCD of 1,079,000 square pixels.

Two image resolutions can be selected — fine or normal. In normal mode 152 shots can be stored on an 8MB CF card. The camera has a 113,580 pixel 50mm colour LCD screen plus an optical viewfinder. Nine shots can be viewed simultaneously on the LCD screen. The flash is detachable.

The DCF5 also has a number of advanced features like nine-shot sequential recording, wide mode, auto date/time recording and supplied edit software. It uses a rechargeable NiCad battery pack which charges quickly and economically in less than 2.5 hours.

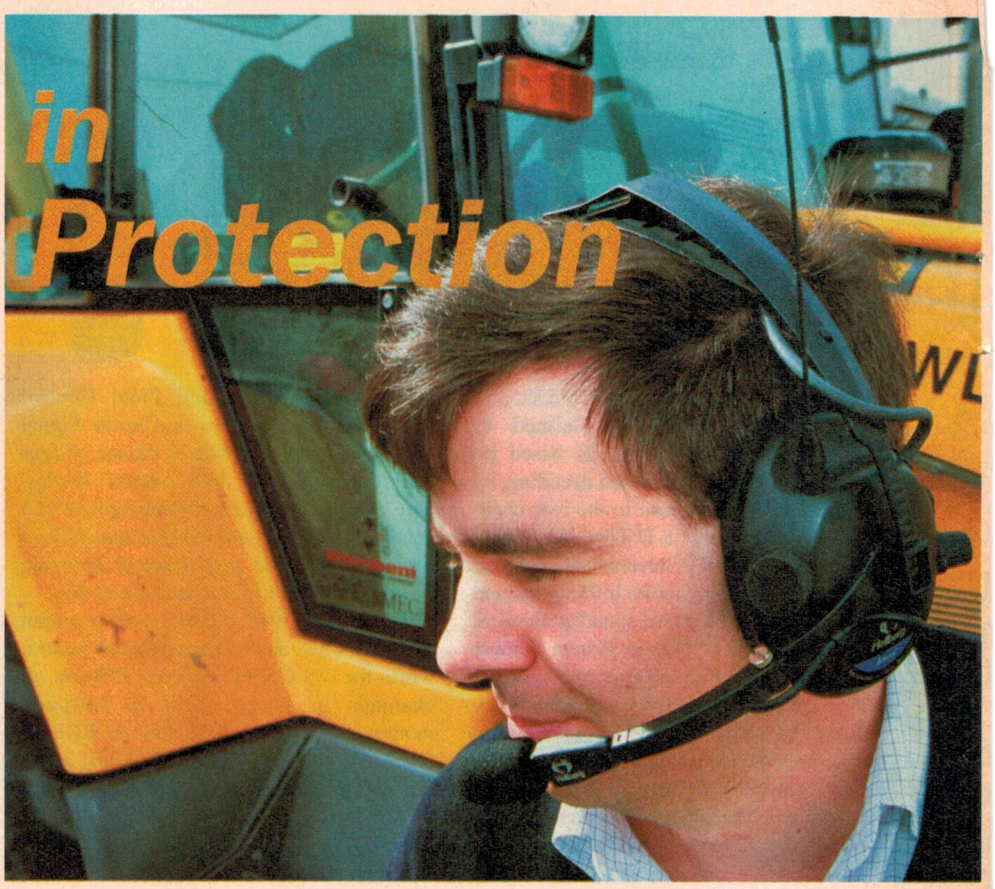
The DCF3 has VGA picture quality (640 x 480) and a progressive scan 350,000 square pixel CCD. Users can choose between fine, normal & economy for picture quality. In economy mode 47 pictures can be stored on a 2MB CF card.

Panasonic has also launched a digital video printer (MPD1) that can print out the images from either the DCF3 and DCFS. The CF card can be inserted directly into the printer's card slot for simple reproduction.

The Panasonic NV-DCF5E digital still camera has an RRP of $1099 and the NV-DCF3A an RRP or $769. For further information circle **140** on the reader service card or contact Panasonic's Customer Care Centre on 132 600. ❖

The Challis Report

Advances in Hearing Protection



This month, reviewer Louis Challis has been checking out examples of the current breed of communications headsets — combining effective hearing protection technology with built-in short range UHF communications. His reaction? They provide a significant amount of protection and convenience for people who need to work in really noisy environments, but it'll be even better when the 'next generation' of devices arrive, incorporating active noise cancellation as well...

ALMOST 40 YEARS ago, I took my first flight in a light aircraft and found that there were things to interest me on that flight other than the view. I sat up front with the pilot and felt very chuffed that I could share nearly all of the visual and engineering excitement of the flight's takeoff, flight and subsequent landing. The cabin was extremely noisy and in keeping with the practice of the day, the pilot wore an aviation headset throughout the journey. I counted myself as being indeed fortunate that the pilot offered me a spare set of headphones so that I could monitor the outward and inward communications with the air-traffic controllers and other pilots en route.

I recall little of the pilot's banter, or the actual communications. I do however remember that even though I wore a relatively new communication headset, I had great difficulty hearing and understanding what was being said. Then, as now, the residual sound levels audible in the muff cups were dominated by the disturbing and intrusive low frequency roar from the engine and propeller...

In the four decades since then, with the exception of Bose communication headsets incorporating active noise attenuation, and some recent design innovations by Bilsom in Sweden, there have been relatively few advances in the design of communication headsets. In fact the fundamental noise attenuation performance of aviation headsets changed little until the late 1980s, when Dick Rutan and Jeana Yeager completed their astounding round the world non-stop flight in the Voyager aircraft. Surprisingly most people have now all but forgotten that momentous flight, even though it opened two distinct yet important chapters in the fields of aviation records and communication technology.

Having refreshed your memory, you will readily appreciate the first of those advances: the Voyager's non-stop flight around the world. The second advance was far less obvious; it has been almost ignored, and came as a result of the crew being the first pilots to make effective use of an active noise attenuating communication system. Both Dick Rutan and Jeana Yeager wore special communication headsets designed and hurriedly constructed by the Bose Corporation for the flight.

The prototype headsets provided them with almost 20dB of attenuation, over the critical low frequency range of 30Hz - 300Hz. That's the frequency range in which the dominant low-frequency noise roared into the uninsulated cockpit, and would have resulted in both Dick Rutan and Jeana Yeager being permanently deafened had they not had the benefit of those revolutionary headsets during their protracted non-stop journey. Instead of ending up being deaf, they were not only adequately protected, but more importantly they were able to communicate effectively with each other — as well as with their support crew and traffic controllers in each of the countries and territories which they were forced to cross.

Almost instantly, active noise reducing headsets became a brand new industry to serve the needs of the military and commercial aircraft and helicopter pilots, as well as army tank drivers, crews on drilling rigs, the engine room crews on large ships and a multitude of equally important people carrying out complex construction activities, where the low frequency noise constitutes the most complex frequency to effectively attenuate.

The problem is that conventional earmuffs and communication headsets generally provide minimal to negligible protection in the low frequency region from 30Hz - 150Hz. Although theoretically attenuated by the normal equal loudness contours of human hearing, that is very the frequency region which still constitutes a significant hearing risk problem.

Over the last decade, my staff and I have evaluated hundreds of new hearing protection devices. As colourful as some of those devices may be, relatively few exhibit technical or electronic advances that have stirred

me or are likely to interest you.

Apart from the development of the Bose Series II Aviation Headsets, the next most exciting development which has stirred our interest has been Bilsom's development of earmuffs with superior low frequency attenuation performance. Bilsom have achieved that result through the development of their innovative Natural Sound Technology (NST) range of earmuffs and communication headsets.

The difference between the NST range and previous generations of earmuffs is that they provide a much flatter attenuation response, so that the higher frequency components of speech which are critical for effective speech intelligibility are attenuated to a lesser degree, while the less critical lower frequency components are more effectively attenuated.

Bilsom achieved these advances through innovative changes to the muff cushion back plate, which incorporates a series of miniature parallel duct structures supplemented by small perforations in the ear cushion backing overlying the perforated back plate structure. This combination of elements ensures that the higher frequency sounds propagate with a controlled frequency response past the cushion into the muff cup.

While the attenuation curve of a conventional set of earmuffs is typified by relatively low attenuation at low frequencies, and very high attenuation in the critical 2-4kHz region, the NST earmuffs modify that characteristic. The important sibilants and fricatives which fall in the 2-4kHz region are less aggressively attenuated in relation to the lower frequencies, so that the distribution of frequencies in normal speech communications can be more naturally identified.

Other players

WHILE THE Bose Aviation Headsets have held a dominant position in the US military and civil aviation fields, there have been other significant players in this field. In particular, more competitive and more economical consumer headphones have been marketed by ANVT and Koss in America. Not to be outdone, Sony Corporation have also been marketing similar noise reducing headphones, focussing on the aircraft travelling market to provide 10-15dB of attenuation in the critical 100-300Hz region.

Frankly if you haven't experienced the subjective improvements during an aircraft flight by wearing active noise reducing headphones, then all I can say is "you just don't know what you've been missing!"

Hellberg's products

MY PERCEPTION of what the hearing protection device industry is doing and where it is going changed, after I examined the latest generation earmuffs and communication headsets from Swedish firm Hellberg Safety. In keeping with its three major Scandinavian competitors, Hellberg has been actively and aggressively conducting research to develop and market superior products. Their approach has been to head off in a different direction, though.

If you have ever visited a construction site which covers a large area or involves the construction of a multi-storey building, or worked in a plant the size of the BHP Newcastle Steelworks, or visited a front-line airforce base, you will be aware of how demanding their communication requirements have become.

Some of the 'NST' range of hearing protection earmuffs made by Swedish firm Bilsom. On the facing page is one of the Hellberg Local headsets.

Invariably a prime requirement of such environments includes the need for multiple communications channels to maintain safety. It goes without saying that there is a simultaneous need to exclude extraneous noise, whilst still maintaining the ability to hear warning and alarm signals. So there's a continuing need for aural acuity, in the presence of equipment, construction, or even intrusive jet engine noise.

A common problem is that most communication headsets or special purpose radio systems in use are invariably based on the design concept in which the user wears a belt mounted or backpack supported radio communication transceiver. With few exceptions, they require the user to activate a push to talk (PTT) function to initiate communications. To change radio channels, you must either look down or otherwise identify the setting for an alternative channel, by touch or feel.

Having worked on many large construction sites and visited large industrial and petro-chemical complexes, I am aware of the extent to which users need to access multiple frequency communication channels in order to communicate with different groups of people working on the site. A common problem is that on many of those work sites, there are significant dangers involved by switching accidentally to the wrong channel; this risks interfering with other groups of workers' critical communications. It's easy enough to do in the urgency and heat of the moment, but can result in another person's working activity, or even their life being endangered...

Appreciating the criticality of these issues, Hellberg is developing an innovative new range of communication headsets, which address many if not most of these issues in a sensible and very pragmatic manner. They have designed a range of hearing protection devices based on new high performance earmuffs, into whose muff cups they have inserted a series of different optional innovative and effective communications systems. These systems resolve many of the more difficult and intractable functional and security problems which industrial, defence and security organisations frequently experience in the field.

Local vs regional

HELLBERG DIVIDES its new hearing protection devices using the descriptors of 'Local' or 'Regional'. The 'local' earmuffs come in four different versions, the most important of the series being the Local 2 and Local 3 models. These provide a useful subjective attenuation performance of 23.5

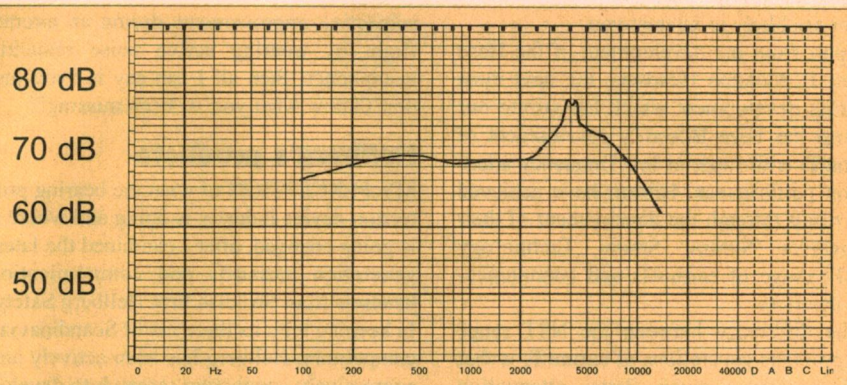
SLC80 (a performance rating based on testing in accordance with the requirements of Australian Standard AS 1269:1989).

Each of these Local communication headsets incorporates the following electronic functions:

- An external microphone on one of the muff cups and an internal amplifier and headphones so that external speech and warning signals are amplified up to a maximum upper safe level at the wearer's ears of 82dB(A). When the amplified sound levels exceed that figure, they are then attenuated and effectively compressed over the frequency region 200Hz - 6kHz.
- Amplification of the wearer's own vocal activity so that when speaking in a noisy environment, the wearer is able to regulate his/her own speech quality as a result of being able to hear and identify the quality of their own speech to maintain sensible communications (i.e., maintenance of an effective audible feedback system).
- Provision of a four-channel FM transceiver system operating in the 433MHz band. Each transceiver provides a 10mW output signal, and an effective communication range which may be as much as 1km under free-field conditions. More significantly the transmission time may be as long as 50 hours before battery recharging is necessary.
- User selectable options of voice-operated transmission (VOX), whose switching level is determined by the volume control setting on the left-hand side earmuff cup. Alternatively the user may select a press to talk (PTT) function mode by pushing of the mode button behind the right-hand side muff cup for more than two seconds. These functional selections are audibly identified by a synthesised voice signal which announces the functional selection of 'VOX' or 'PTT' modes depending on your selection.
- The synthesised voice signals are also provided each time the operating channel frequency is changed, with the announcement of 'C1' or 'C2' or 'C3' or 'C4' in sequence, following the pressing of the channel advance button.
- Provision of an adjustable noise cancelling microphone with its own windscreen, which can be positioned in close proximity to the wearer's lips to facilitate external communications to satisfy the working environment and related prevailing noise levels.
- Provision of a four-hour auto cutoff function, so that the battery will not be inadvertently drained during prolonged periods of non-use.

This aggregate set of functions and features 'fits the bill' for many, but obviously not all applications. One obvious situation which I have experienced on a number of occasions, involves the need to be able to communicate using a mobile telephone in a noisy environment. This has become a more frequent and compelling requirement, especially for electronic and computer service personnel working in mines, power stations, plant control rooms, and even in engine rooms of large cranes or draglines.

Well aware of this need, Hellberg consequently released their Regional range of hearing protection devices. These incorporate a cable attachment which will plug directly into a number of different brands of mobile phones. Using a Regional headset you can therefore talk directly to a remote person or organisation, with ease and acceptable clarity.



Measured overall response of a pair of Hellberg Local communication headset/earmuffs, which provide an effective voice link over at least 200m.

Trying one out

IN ORDER TO assess the manufacturer's claims, we performed a number of subjective and objective performance evaluations on a series of Hellberg Local communication earmuffs. The first series of tests involved an evaluation of their subjective real ear attenuation, with a sample group of 20 students. The results revealed a reasonable attenuation performance, which provided a 'mean minus one standard deviation' performance conforming to a 23.5 SLC80 rating.

The next test I performed involved an evaluation of the frequency transmission bandwidth of the combination of microphone and FM transmitter in one communication headset, whose signal was then received by a second communication headset operating on the same channel. For this evaluation I mounted the throat microphone of one Hellberg communication headset on a constant sound source (a small diameter sound source equivalent to a human mouth, whose output level was maintained at a constant 80dB sound pressure level by means of the compression circuit in a swept oscillator. The receiving communication headset was then mounted on a Bruel & Kjaer Type 4153 artificial ear, whose output was then recorded by a measuring amplifier feeding directly into a level recorder.

I was pleased to discover that the resulting frequency response was relatively smooth and relatively flat over the frequency region extending from 150Hz - 2kHz. Above 2kHz the response exhibited a rapid rise of +10dB in the vicinity of 3.5 - 4.5kHz, followed by a droop in the output response down to 8kHz.

The last objective test confirmed that the Local communication headsets are capable of maintaining effective communication quality transmission and reception at distances up to 200m. This test confirmed that even in the presence of high level of traffic noise and other intrusive sources, the Hellberg Local headsets provide an excellent instant communication capability.

Summary

AS EXCITING AS these products may be, the concept of combining those communications functions with an active noise reduction system would appear to offer expanding their capabilities by an order of magnitude. While Hellberg and its competitors have not yet released this new generation of products in Australia, I am aware that such products have just been released in USA and in Europe. In fact I hoped that one of them would be the subject of this review.

Disappointingly this didn't prove possible, but when they do arrive here their major advantage will be superior communications, dramatic improvements in comfort level, and significant advances in hearing protection.

Obviously there is a price to pay for these advances, but the marketplace has already accepted that regardless of price, performance is crucial. The majority of large national or multinational companies and corporations put safety and performance well in front of the secondary factor of cost. ❖

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You've come a long way, Baby!

(A saga of itty-bitty digital cameras)

Undaunted by some of the criticism we've received about digital photos, and despite (because of?) his background as a photographer, Tom Moffat has confirmed his conversion to digital by upgrading to an Epson PhotoPC 550. It isn't one of the latest megapixel marvels, but Tom's nonetheless rapt...

by Tom Moffat

A COUPLE of years ago *Electronics Australia* was concentrating hard on digital cameras — the latest pictorial technology, very promising indeed. But back them, the technology was more optimism than fact. Some cameras were pretty good; others were... well, woeful!

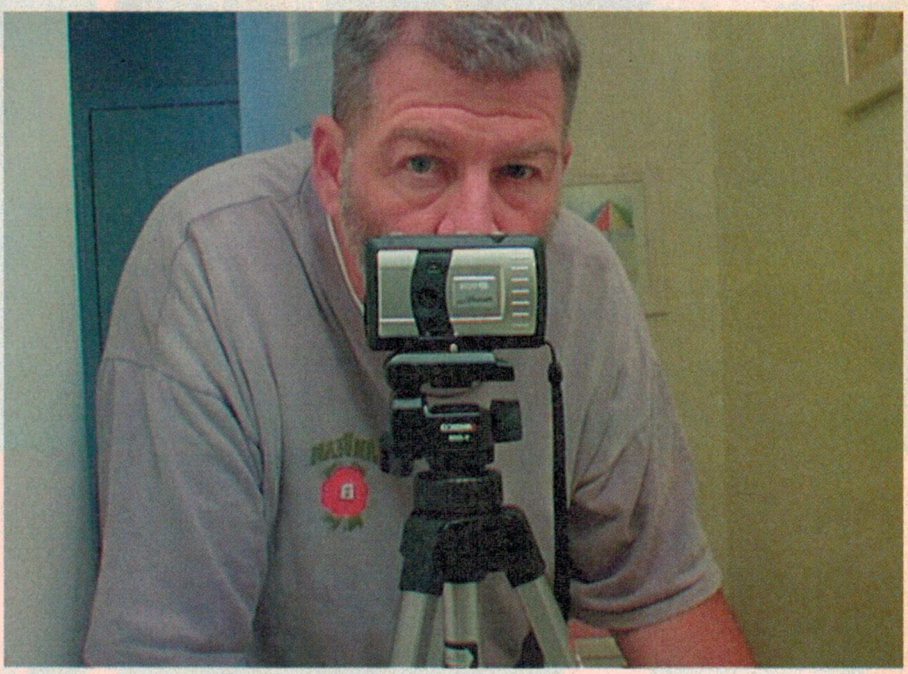
Still, digital cameras wormed their way into professional circles, and *Electronics Australia* started to use digital photographs in a big way. So big, in fact, that at least one reader wrote to complain that the magazine's standards were falling because traditional film was being replaced by digital pictures.

I was one of the worst offenders. From the day I got my trusty Epson PhotoPC 500, *EA* never again received a piece of film from me. All my photos have been digital, e-mailed to Sydney, instantly and free.

Now the blight is spreading. At least one newspaper in my part of the world, the *Peninsula Daily News*, has gone almost totally digital. I discovered this when a *PDN* reporter turned up to interview me and a colleague when we started our jobs at the new community TV station. I took one look and asked, "Is that a digital camera?". And sure enough, it was — an Olympus D-500L (called the C-1400L in Oz, I think). His photo ended up big and bold, on the paper's front page in the lower right corner.

My own Epson continued to crank out the work — magazine articles, web page photos, even still images for use in TV productions. The number of pictures the Epson produced must number well over a thousand — for no more than the cost of a handful of penlight batteries.

So I was totally happy with my camera; that is, until a friend bought the next Epson up the line — a PhotoPC 550. This is a complete re-design of the original, scrunched down to the size of a pack of cigarettes. Other photographers who've seen it say the camera is smaller than their light meter. And it makes



The PhotoPC 550 photographing itself (and Tom) in a mirror. As you can see it's quite compact.

absolutely smashing pictures if you're prepared to deal with its way of doing things.

The PhotoPC 500 had an excellent flash, complete with automatic operation and red-eye reduction. The PhotoPC 550 dropped the flash altogether, depending entirely on natural light for all its photos. The specs say the camera's sensitivity is the same as 100 ASA film, and this is probably the case up to a point.

Professional video cameras have a feature called 'gain' which can boost the sensitivity of the image amplifier to produce reasonable pictures under poor light. The price you pay is some noise in the resulting picture if gain is used to the extreme.

When light falls below a certain level, the PhotoPC 550 appears to wind up the gain to compensate. In a normally-lit indoor situation, the 550 produces excellent pictures, without a flash, although the shutter speed may be somewhat slow and a tripod might be appropriate. But there's none of that in-the-face flash effect, and the pictures look totally natural. The photo of the newspaper reporter was taken under these conditions.

Epson says if there's enough light to read a newspaper by, then the PhotoPC 500 will take good pictures. But in practice you can push it well beyond that. The camera keeps trying, more gain comes in, and eventually the pictures begin to get noisy. The photo of the couple was taken in an outdoor beer garden behind a pub. The sun had set an hour earlier and the only light remaining was a soft glow from the sky. Yet the image caught the full mood of the moment, two lovers relaxing at the end of the day.

The PhotoPC 550 is NOT Epson's latest

A surreptitious shot of a couple in the 'Sirens Tavern' beer garden in Port Townsend, at dusk (available light only).

and greatest, and thus it's selling in the USA right now for US$249, half what I paid for my PhotoPC 500. By sheer luck, one of my computer clients asked me if I could help him find a cheap digital camera so he could shoot flash pictures of his employees working in the factory, for use on his web page. That was an ideal job for the PhotoPC 500 since it has such an excellent flash. So the deal was done: he bought my old PhotoPC 500 for $200, and then I ordered the newer PhotoPC 550 for myself for $49 more.

When the PhotoPC 550 dropped the flash, it replaced it with three new features: a way to make sound recordings, swappable memory cards, and a macro lens. The sound function can record exactly six seconds of sound through a tiny microphone in the back of the camera, and store it as a .WAV file the same size as a picture file. This is presumably for verbal note-taking, but I think it would be much more fun to record your own custom Windows sounds. For instance, instead of the wimpy little guy saying "you've got mail!", you could record a message saying "you've got mail, but you're going to have to learn to read first!" — and then slip it into a friend's computer.

Memory cards for the Epson are known as 'SmartMedia' cards. They're about the size of a large postage stamp, and not much thicker, yet digital camera versions hold up to 4MB of data. They seem to be becoming a standard; the Canon digital camera also uses SmartMedia cards.

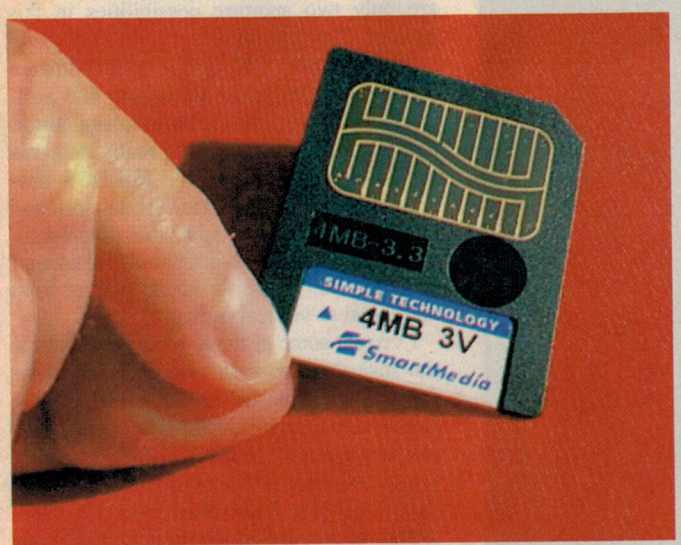
The PhotoPC 550 offers three levels of resolution. The first two levels are identical to the ones offered in the earlier 500 camera, where the highest level produced a JPG file around 50KB in length. The 550's third level produces JPG's around 100K long. A 4MB SmartMedia card will hold 36 of these pictures, so it can be considered the same as a 36-exposure roll of 35mm film. SmartMedia cards are now around $US25 apiece, so when I ordered my PhotoPC 550 I also got four cards for an extra $100.

I bought a tiny camera case locally, so now I can carry around the camera, a spare set of penlight batteries, and three spare 'rolls of film'. This is going to be absolutely super for bushwalking trips; the whole rig weighs almost nothing, and when I get home I can download four 'rolls' of 36 pictures each into my computer, erase the memory cards, and start all over again.

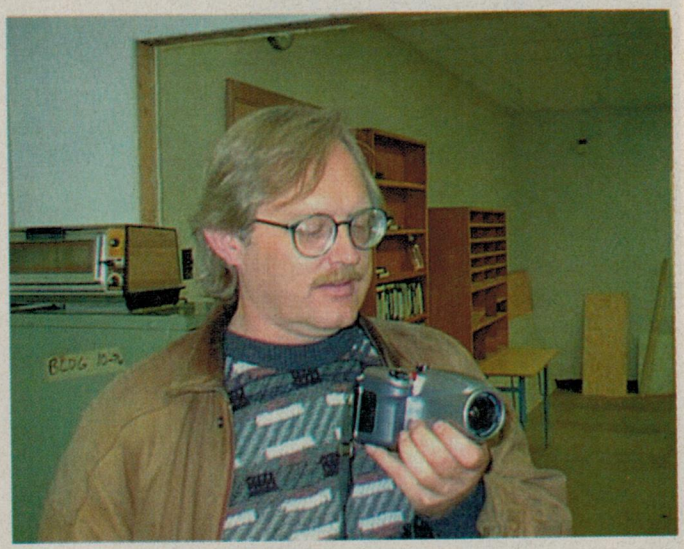
Now to the macro lens: The photo of the memory card shows what it can do. You can see the individual strands of cotton in the woman's blouse. Close-up photos of a flower or a leaf can show individual water droplets. It's a whole new world, and it doesn't take long to get hooked on this kind of photography.

I've found a foolproof path to success is to pour in heaps of light to ensure a reasonable depth of field and a fast shutter speed. The memory card was photographed in bright sunshine, carefully positioned to avoid shadows.

Overall, I've found the PhotoPC 550 excells in two special fields. One is candid photography — with such a tiny camera, and no need for a flash, you can get away with just about anything. When the two lovers were photographed, they never noticed, even though I was sitting at a picnic table less than



A close-up of one of the SmartMedia memory cards used in the PhotoPC 550, taken using its macro setting.

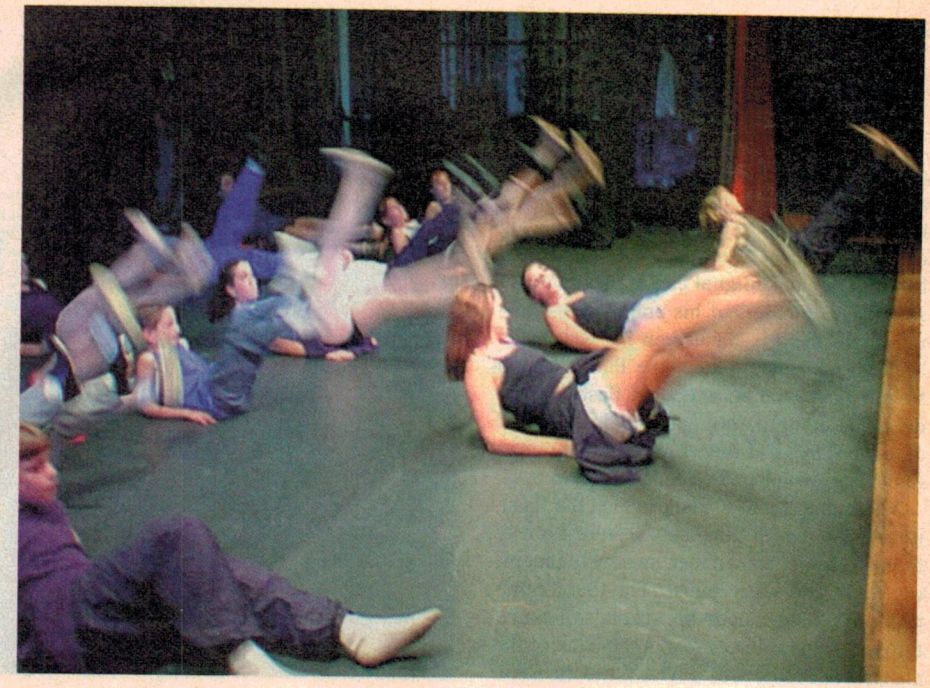


Peninsula Daily News reporter Phillip Watness, with his Olympus D-500L digital camera. Its shots are used even on page 1...

two metres from them. Invasion of privacy? Well, it *was* a public place...

The other application where the camera really shines is rainforest images in the style of the late Tasmanian nature photographer Peter Dombrovskis, who taught me a lot of his techniques. The trademark of Peter's photography was images of flowing water, brought about by the use of a very slow shutter speed. Peter often used 4x5 or even an 8x10-inch transparencies, so he had to carry an enormous camera and tripod on his bush-walking trips. He'd turn in his grave if he saw me doing much the same thing with a camera I can carry in the pocket of my bush shirt. A slow shutter speed is also useful in images such as the dancers warming up, showing their legs in motion.

Except for selecting the macro lens, the PhotoPC 550 is a point-and-shoot camera, so you have no control over what it does. But you can find out after the event by looking within its JPG files with a text viewer (not a picture viewer). If you scroll down through the gibberish you soon come to an interesting plain-language display of data about that picture. There is the time and date (undecoded), shutter speed, f-stop, resolution, image size, whether the macro lens was used, the owner's name, and entries for flash and zoom which don't even exist in this camera (yet).



Dancers warming up for a performance in Port Townsend, Washington USA.

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Left: The sort of information you can find buried in a JPG image file from the Epson PhotoPC 550, using a text viewer like List.

It's easy to determine shutter speed — the number represents how many microseconds the shutter was open. The example shown is from the memory card photo; dividing the shutter speed into one million, and inverting, comes up with approximately 1/500 for the shutter with f/8 for the aperture (there was LOTS of light). There are only two aperture possibilities in this camera, f/2.8 and f/8.

The PhotoPC 550 comes with software much improved from the earlier 500 software, and there's also a basic image editor. But a camera of this quality really deserves something better. I use the MS-DOS program 'Quick Picture Viewer' to sort and view the photos, and the shareware Windows program Paint Shop Pro when I want to edit, resize, or rotate photos from horizontal to vertical format.

I've sent some of these goodies so that *EA* can stick them on their web page for reader downloads. Look for QPV17E.ZIP for the picture viewer, and I've also posted the popular List program (LIST93A.ZIP) for snooping within JPG files (and other stuff too — very useful). As for Paint Shop Pro, it's enormous... so you can download it yourself from the manufacturer's site: **http://www.jasc.com/psp5.html**. ❖

Port Ludlow marina on a calm day (reflections...)

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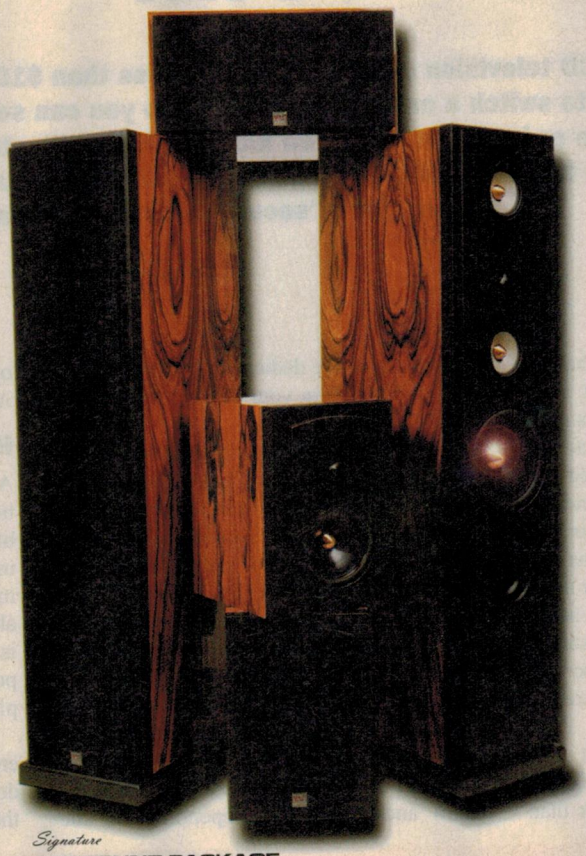

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"One could be forgiven for thinking that these speakers were 10 times the price...The stereo imaging was truly outstanding...The VAF Signature I-51 system has one of the finest high frequency responses of any
Electronics Australia

"Are these the best kit speakers in the world?...On the evidence, we'd have to say that VAF's I-66 design would be odds on favourite to take out the award."
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"... don't think there's any other way you could obtain this high level of sound quality at such a low price..."
Australian Hi-Fi

"The VAF DC-Series home theatre system exhibits a new benchmark of excellence in every criteria: construction, design finish , innovation...it seems almost churlish to mention the astounding value that each of these components represents."
Best Buys Home Theatre

"A new benchmark in excellence in every criteria: construction, design, finish, innovation."
Best Buys Home Theatre '97 '98

"Highly and unreservedly recommended."
Best Buys Home Theatre

"... In value for money stakes or even sound for dollar stakes for that matter, they're nigh on impossible to beat."
Australian Hi-Fi

"We love the DC-Xs. These are true high fidelity speakers, and deserve a pedigree second to none. we are confident that that will be the case in time. Their performance is a revelation. The combination of the DC-Xs, the DC-6 and DC-2s is a happy, fully compatible, articulate and balanced system that beats anything we can think of in its price range. Actually,probably close to twice its price range."
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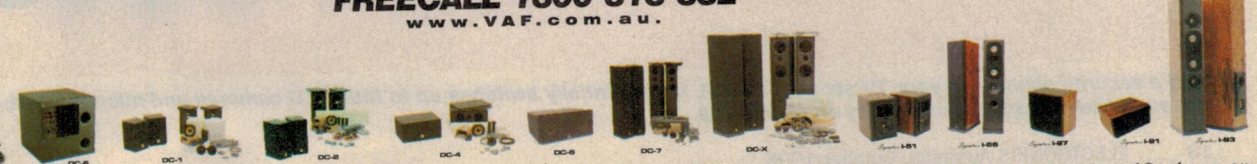

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READER INFO No. 5

A 'Security Channel' for your TV Set...

CCD television cameras now cost less than $100. But what about the 'bit in the middle', to switch a number of cameras so you can see what's happening around your home or business? This new kit from Oatley Electronics interfaces up to four CCD cameras to a conventional TV set, with each camera automatically selected in turn. It gives you a 'security channel' you can monitor during the ad breaks.

by Peter Phillips

The kit is called a four channel audio/video switcher. The circuit automatically and sequentially switches up to four surveillance stations (camera and microphone), and outputs the selected station to an RF modulator tuned to channel 38. The modulator is connected between the incoming cable from your TV antenna and the TV set, so you can still watch your usual TV channels. However, when you select channel 38, you see each surveillance station selected in turn and displayed on the screen. After checking each station, you can return to the program you were watching.

For example, in the home you might want to monitor a baby, someone who's sick, the front door and the backyard. So rather than buying a separate dedicated monitor, this kit lets you do it from your lounge room on the family TV set.

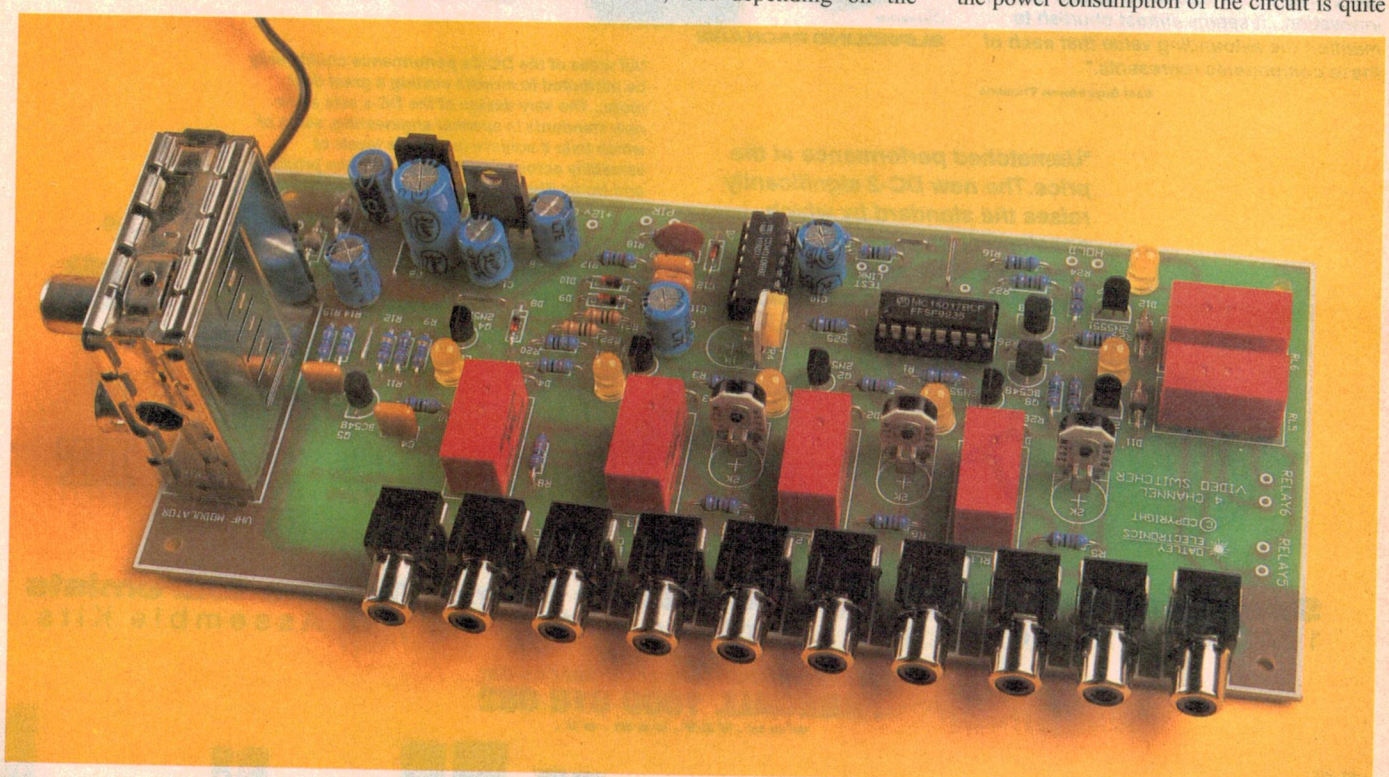
The on-board modulator has a test pattern to facilitate tuning the TV set, and can also be set to give a 6dB boost to the antenna signal, to compensate for losses in a splitter or to simply add gain to the signal. If you have a video monitor, or a TV set with direct video/audio inputs, you can also use the direct video and audio outputs on the board, eliminating the need for the modulator.

There's more, as you'll read later. But first a word on the price of the kit. Commercial units that switch four video inputs (no audio) cost over $200. This kit not only switches audio and video, but depending on the options you choose, costs less than $70. Actual prices are at the end of the article.

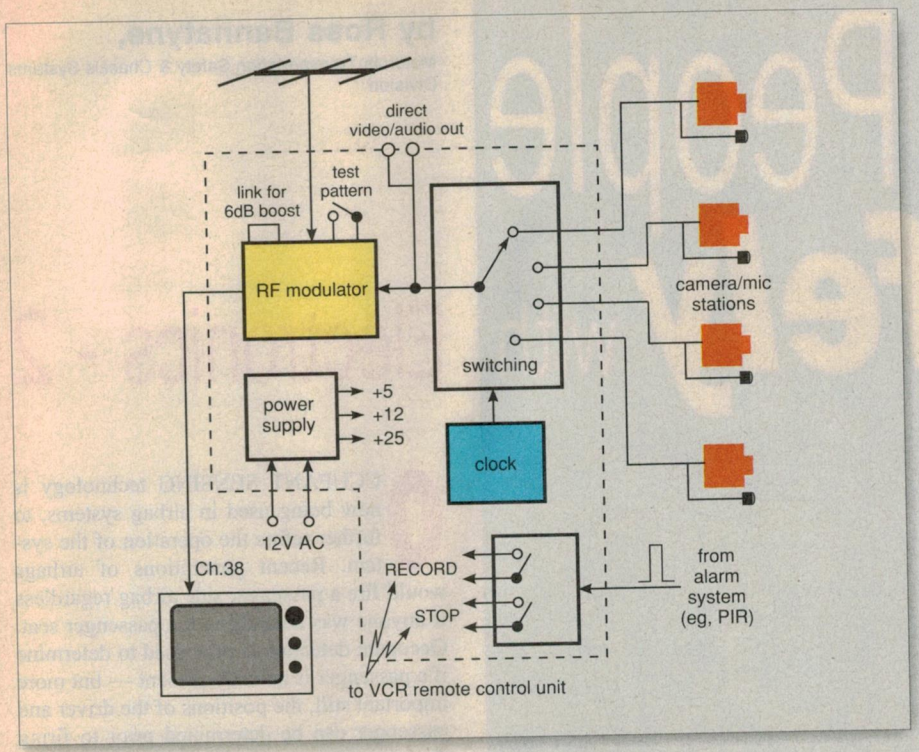
How it's done

As you can see in the photo, the switcher is built on a single printed circuit board. The block diagram shows the main functions, including a section to set a VCR into record mode after a trigger signal from an external alarm system or a PIR detector. This section is separate from the switching circuit, but is powered from the same on-board power supply. We'll have more to say about it later.

All switching is done with 48V relays powered from a 25V DC supply. These compact double-pole relays take less than 10mA, so the power consumption of the circuit is quite



Add a security channel to your TV set with this kit. It sequentially switches up to four CCD cameras and microphones, and modulates the audio/video signal for reception on channel 38.



A block diagram. The audio and video signals from each station are switched with relays. The dashed outline represents the printed circuit board.

small, and the relays are almost silent when switching. The board is powered from a 12V AC plug pack. The on-board power supply has a voltage doubler to produce 25V DC for the relays, a 5V regulator to supply the circuit and a 12V regulator to power the cameras.

The cameras and microphones connect to the board via PCB-mount RCA sockets. Separate RCA sockets are included for direct video and line level audio outputs, for direct connection to a TV monitor or VCR. The modulator has an RF input socket for the antenna lead and an RF output socket for a lead to the RF input of a TV set.

The relays are switched in turn by a 4017 counter. The switching rate is adjustable, and the number of stations selected by the counter can be set with links. That is, you can set it anywhere from one to four cameras. There's also a manual hold pushbutton to hold the counter on a selected station...

The circuit uses electret microphone elements (supplied in the kit), and the supply voltage for each microphone is adjustable to eliminate clicks during switching. The output of the selected microphone is amplified before being fed to the modulator and the direct audio output socket.

VCR interface

This section is similar to the VCR interface described in *EA* for May 1996. It has two relays, one for record and one for stop. The relay contacts need to be connected across the appropriate buttons on the remote control for the VCR you want to use. A pulse from an external alarm system (or a PIR detector) triggers the circuit so the 'record' relay pulses on. It everything is set up correctly, the VCR then records the video/audio output of the switcher.

After a minute or so, assuming there's no further trigger pulses, the 'stop' relay turns on briefly, stopping the VCR. You can use a learning remote, modified to suit, rather than the original VCR remote control. You can also wire directly across the record and stop buttons on a VCR.

Building the kit

The kit comes with everything you need, including a high quality silk-screened printed circuit board. A layout diagram and circuit are also included. We found construction very easy, as the layout printed on the board gives component values as well as numbers. Sockets are provided in the kit for the two ICs, and there are no hidden nasties like links under IC sockets.

Setting it up is also quite easy. On-board LEDs indicate when any of the six relays are on, so you can tell at a glance what's happening. Apart from the modulator, there are four pots to adjust: three to remove audio clicks from the microphones during switching, and one to set up the switching rate. None of these adjustments is critical.

The modulator comes pre-tuned to channel 38 (607.25MHz), but can be adjusted for any channel from 28 to 47. Setting a switch on the modulator causes it to produce a test pattern, which is particularly useful with auto-tune TV sets. There are three adjustments on the modulator: video level, audio carrier frequency (5.5MHz) and the RF output frequency.

As already mentioned, the modulator can provide around 6dB of boost to the incoming RF signal, by linking a pin from the modulator to the 5V supply. The printed circuit pattern comes with this connection made, so if you don't need it, simply cut the track between pins 3 and 5.

Links on the board let you select the number of surveillance stations. We felt the arrangement to do this could be simpler, but it's easy enough once you realise the counter is reset from the next higher order output. So if you want three stations, connect pin 15 (reset) to output four (pin 7).

The results

We had no problems connecting the completed unit to a conventional TV set. The picture quality is good, and the sound level quite adequate. We connected two cameras and microphones with lead lengths of around two metres, but with suitable coax, you can extend this to over 50 metres. We used the on-board 12V DC supply to power the CCD cameras, which typically take around 50mA each.

We didn't connect the VCR interface to a remote control unit, but you can easily check its operation by looking at the LEDs that indicate when the relays are on. A 5V pulse at the input should trigger the 'record' relay, and after a minute or so, the 'stop' relay should briefly operate.

Summing up

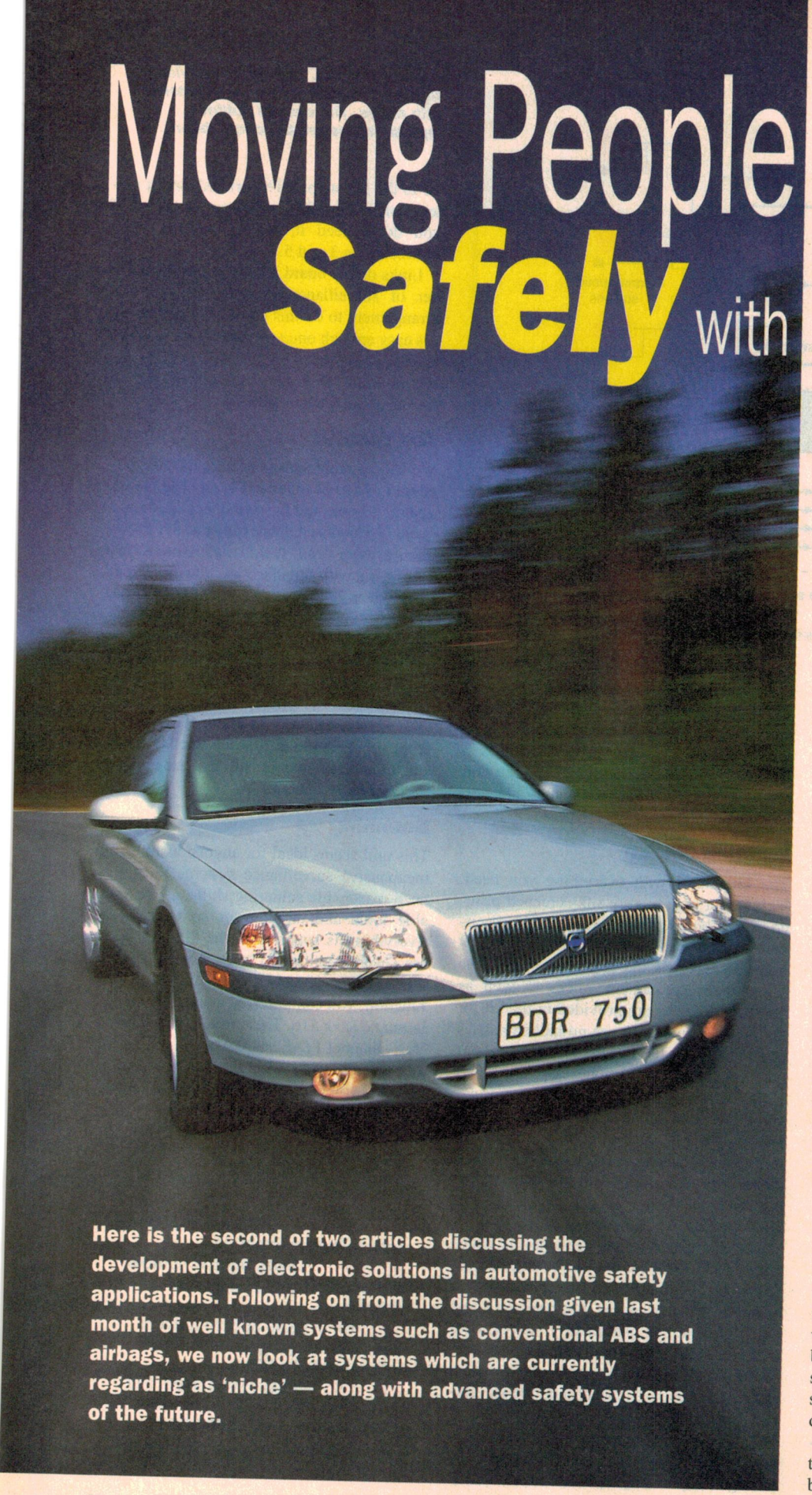
This unit seems ideal for anyone wanting an inexpensive surveillance system. You only need reasonable soldering skills, a few suitable tools and an hour or so to built it. Everything is supplied in the kit, and there are several options to keep the cost down. For example if you don't want the audio function, you can purchase a cheaper modulator and save $16. This modulator works on VHF channel 1 (adjustable), and costs $2. Or you can do away with the modulator altogether if you have a TV set with direct video and audio inputs. ❖

Oatley Video Switcher Kit

Good points: Versatile, inexpensive, easy to build and set up.
Bad points: Selecting the number of stations to switch could be simpler.
RRP: Kit of parts $65, modulator $18, 12V AC plug pack $7, P&P within Australia $5.
Available: Oatley Electronics, PO Box 89, Oatley 2223; phone (02) 9584 3563, fax (02) 9584 3561 (**http://www.ozemail.com.au/~oatley**).

Moving People Safely with Electronics - 2

by Ross Bannatyne,
Motorola Transportation Safety & Chassis Systems Division



Here is the second of two articles discussing the development of electronic solutions in automotive safety applications. Following on from the discussion given last month of well known systems such as conventional ABS and airbags, we now look at systems which are currently regarding as 'niche' — along with advanced safety systems of the future.

OCCUPANT SENSING technology is now being used in airbag systems, to further refine the operation of the system. Recent generations of airbags would fire a passenger side airbag regardless if anyone was actually in the passenger seat. Occupant detection is now used to determine if a passenger is actually present — but more important still, the positions of the driver and passenger can be determined prior to firing the bags. This means that the occupants can be be pulled by motorised seat belts into the safest position, prior to the bags deploying.

Electric fields are often used for occupant detection. Conductive strips are placed in the seats and are used as antennas to generate the fields. The mass of the occupant will affect the capacitive conductivity of the field. An amplifier is required to boost the analog signals, then a microcontroller would be used to decode the field variations to determine occupant position.

Both infrared and ultrasonic systems have also been proposed as occupant sensing technologies. These approaches basically bounce a signal off the passenger (or empty seat) and examine the reflected waves in order to determine the occupancy status. Another popular technology which has been used is a camera which interprets pictures of the seat locations. Actually, such systems usually filter out the 'background' seat locations and process pattern recognition algorithms to establish the occupancy.

Brake Assist

ABS PENETRATION into vehicles rose steadily, until accident statistics indicated that not all drivers were using ABS effectively. The problem that sometimes arises is that many drivers do not brake hard enough for the ABS to engage. Often, the same drivers who do not put enough pressure on the brake pedal have slower reaction times and subsequently need to slow the vehicle in shorter distances. Brake-assist systems were developed to address these problems.

The function of the brake assist system is to detect when a panic braking maneuvre has been initiated and to automatically apply

maximum braking force, thus engaging the ABS. This is done by means of a sensor on the brake booster which transmits information on the speed of pedal travel to the ABS electronic control unit. If the speed exceeds a pre-determined rate, a 'panic' situation is assumed and the controller enables a solenoid in the booster which provides full boost by ventilating the pressure chamber to atmospheric pressure.

The boost is disabled when the brake pedal is depressed. From an electronic control standpoint, the brake booster requires only minimal additional hardware and software over a regular ABS system.

Collision Warning/Avoidance

ALTHOUGH collision warning and avoidance systems may still be regarded as being in their infancy in terms of vehicle penetration, their perceived value in enhancing safety and reducing accidents is high. As the driving public ages, they expect to continue to be able to drive safely, whilst their reaction time is increasing and other senses like sight and hearing are diminishing.

Work on radar systems for vehicles has been taking place since the 1950s and has been well documented; however most of this work did not lead to practical and economically viable products. This was mainly on account of the limited existing electronic controls on vehicles which could be re-used, and the high cost of enabling technologies such as semiconductors (mainly analog based at the time) and radar systems.

There are two categories of systems available or under development; *passive* collision *warning* systems and *active* collision *avoidance* systems. The passive system will detect a hazard and alert the driver to risks, whereas the active system will not only detect the hazard but also take preventative action to avoid collision if possible. Both types of systems require object detection, the main difference in them being how a collision diverting event is actuated following object detection — by the driver, or automatically.

Both active and passive systems operate on the same principles of object detection, although the active system will control throttle, braking and in the future, steering systems in order to avoid front collisions.

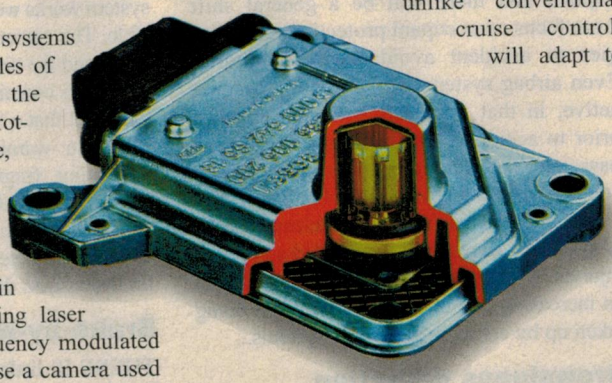
There are several different techniques used for obstacle detection, the main approaches being a scanning laser radar sensor, FMCW (frequency modulated constant wavelength), or else a camera used in conjunction with an algorithm which will detect hazardous objects. This detection system is usually mounted at the front of the host vehicle in order to detect objects in the vehicle's forward path. Other techniques may involve a combination of different sensors, including 'back-up' sensors.

AimRite of San Diego has just released its COAST (Computer Optimised Adaptive Suspension Technology) system, claimed to provide unparalleled comfort, stability and safety.

For frontal systems, long range and large azimuth resolution radar is required because of the high forward speed of vehicles and the need to determine objects in adjacent lanes. The forward range of these systems is usually about 100 - 200m; this distance would give around three to six seconds warning of a stationary hazard when the host vehicle is traveling at 100km/h.

It is important that frontal systems can distinguish when there is more than one vehicle in front, positioned very closely but in different lanes. Frontal radar require a higher frequency of operation (and thus shorter wavelength) than rear systems, as better azimuth resolution is obtained at higher frequencies.

Note that some manufacturers prefer to call the frontal active system 'Autonomous', 'Intelligent', 'Active' or 'Adaptive' cruise control. These systems are a subset of a collision avoidance system and unlike conventional cruise control, will adapt to the speed of slower vehicles ahead automatically. Only a frontal radar system is required for these systems, although it will become more common to implement object detection sensors at the sides and rear of the vehicle in the near future.



Bosch has developed this rotation-rate sensor, for use in the next generation of Vehicle Dynamics Control (VDC) systems. (Courtesy Robert Bosch Australia)

A key difference between the object detection system used in active and passive systems is that the active system will require more accurate object recognition, so as to discriminate against collision avoidance maneuvres relative to objects such as road signs.

Basic object detection is relatively straightforward. The most challenging problem is determining if an object is potentially hazardous, whilst traveling at speed and where many objects are present. It may be possible to detect all obstacles, but if a warning is given to the driver under these circumstances, there will be false alarms which will be irritating to the driver — and a 'cry wolf' phenomenon may result, which will defeat the purpose of having a warning. In the case of a collision avoidance system, automatic braking on account of a false alarm is likely to be dangerous.

The most popular technology to implement the frontal collision warning system today is the scanning pulse-based radar. The principle of operation of the scanning pulse-based radar is very straightforward: the time of flight of a pulse is measured, which is proportional to range.

The scanning radar transmits a pulse of light in a horizontal line, back and forth (hence 'scanning'). Distance is calculated easily as the microcontroller timer can determine the time interval from the transmitted pulse and the received pulse. After each pulse transmission, the receiver looks for an echo pulse, hence the transmission is not continuous. The pulse radar is often referred to as Laser Radar, as a pulse laser diode is used as the emitting device.

As the transmission frequency is phase coherent from pulse to pulse, it is also possible to measure Doppler shift of the target; the Doppler shift can yield motion, speed and direction. Doppler shift occurs as the frequency of the waves are shifted relative to the receiver as the source of the waves gets closer or moves further away.

Consider a police car traveling with its siren on. As it approaches, the siren's pitch becomes higher, then it gets lower as the vehicle moves away. This change in pitch occurs because there is a shift in the frequency of the sound waves. This phenomenon allows us to determine motion — whether an object is traveling towards a receiver, or further away. By measuring the rate of change of the frequency shift, speed can also be determined.

A simplified control circuit for this type of system is shown in Fig.1. The circuit consists of a microcontroller (MCU) which executes the control algorithm and generates output signals to control the laser diode. The laser diode signal is reflected via a system of mirrors and lenses (indicated by the 'Transmit & Receive Optics' block) which is controlled by a stepper motor. The motor is used to step through different positions and allows the beam to be deflected horizontally in a scanning motion.

In each position, the beam will be reflected back to a complementary positioned mirror, through a photodiode and back to the microcontroller. The microcontroller will then calculate distance. The time value is measured using a counter (integrated with the microcontroller) which is enabled when the pulse is transmitted and read when the input is received from the signal amplifier. Because the speed of light is 3×10^8m/s, the microcontroller clock speed must be reasonably high in order to measure distance with acceptable resolution.

A second photodiode is also used in the system to determine if the optical port of the system is clean and free from debris. If the port glass is dirty, the laser beam pulse may be scattered and performance can be affected. Bad weather can also affect performance, although this may be overcome by increasing the output power of the laser pulse. The addition of the photodiode to detect clarity of the optical port is necessary, as this type of frontal scanning pulse radar system is likely to be mounted at the front of a vehicle where debris and dirt from the road is commonplace. One solution is a 'wiper' system for the optical port.

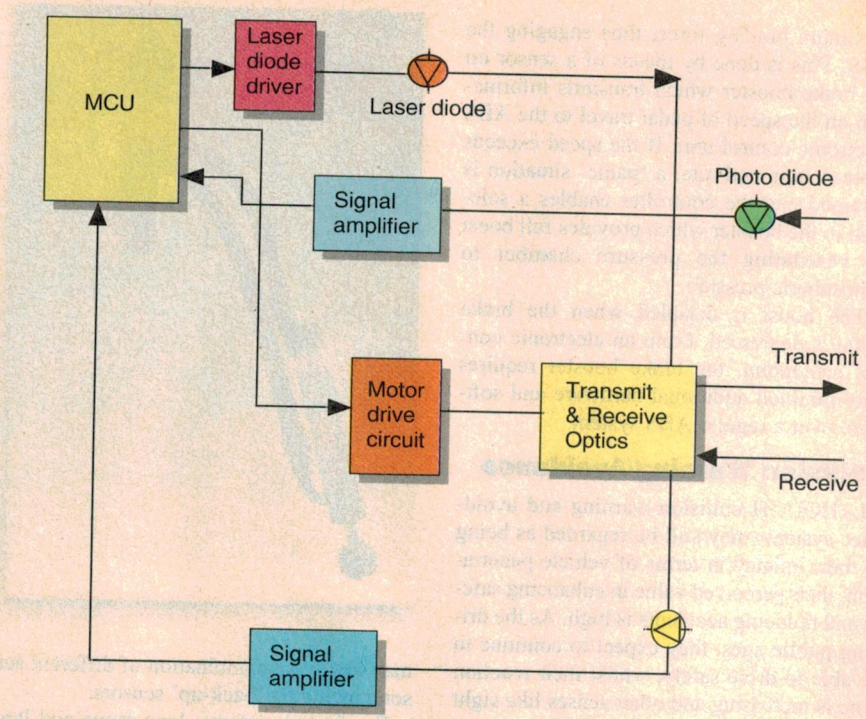


Fig.1: A simplified block diagram for a scanning-pulse based optical radar, used to implement a frontal collision avoidance sensor.

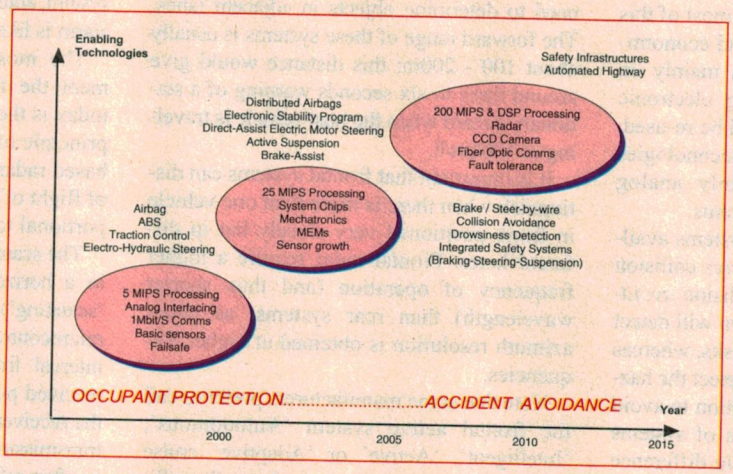


Fig.2: A roadmap showing emerging auto safety applications and the necessary enabling technologies.

Future trends

FIG.2 ILLUSTRATES a roadmap which indicates emerging automotive safety applications, along with the enabling electronics technologies which will help to facilitate them. All of the key applications which are are shown on the roadmap are discussed in this article.

The general trend which is being followed is that many of today's existing systems are becoming integrated together to share information and thus complement each other. A future example of this concept would be perhaps if the steering system were to malfunction, the vehicle could be steered safely to a stop at the side of the road using brake forces on the appropriate brakes.

Another trend which will accelerate is that active safety systems will become more popular and there will be a general shift from focus on occupant protection technologies to accident avoidance technologies. Even airbag systems will someday become active, in that they will anticipate crashes prior to accidents and fire bags *outside* the passenger cabin in order to cushion impacts and dissipate the energy of collisions.

The implementation of these enhanced safety systems will result in lives saved and fewer injuries. It will also mean the continuation of an increasing part of the vehicle budget being taken up by complex electronic systems...

Drowsiness detection

ANYONE WHO has come close to falling asleep in a vehicle can appreciate the value of a drowsiness detection/warning system as an aid in preventing accidents. These systems are being developed using CCD (charge-coupled device) camera technology to analyze facial images and monitor blinking behavior as a measure of driver alertness. An alertness inference algorithm is processed in a powerful microcontroller or DSP unit in order to perform the image processing and make the decision to warn the driver.

Early indications are that the CCD camera system works well, as accurate detection is possible. The camera is installed in the instrument panel and the associated electronic control unit would be contained behind the dashboard. In the event that a 'drowsy' condition is detected, an audio warning signal is enabled and a refreshing fragrance (such as menthol or lemon) may be discharged to 'perk up' the driver. It is feasible that the CCD camera used in an occupant detection system could be re-used for drowsiness detection.

Brake-by-wire

THERE IS little doubt that today's standard braking system, which uses hydraulic fluid, will be replaced by fully electrical systems in the future, as the 'brake-by-wire' implementation has the following advantages:

- No brake fluid; ecologically friendly and

reduced maintenance.

- Lighter weight
- Increased performance (brakes respond more quickly)
- Lower brake wear (spreads load across wheels more evenly)
- Simpler/faster assembly and testing (modular structure).
- More robust electrical interfacing.
- No mechanical linkages through bulkhead.
- Further electronically controlled functions could be added with very little complexity.
- Consistent characteristics of pedal, constant travel
- When a trailer is involved, brakes will respond simultaneously on both carriage and trailer

There are however some major issues which first have to be addressed, before brake-by-wire systems are adopted. One issue is the actuation energy required for braking. A disc brake requires approximately 1000 watts of actuation energy and a drum brake requires around 100 watts. Today's vehicular power management systems cannot support these energy requirements.

Future vehicular power management systems will be based on higher voltages — this paradigm shift will be an enabler for brake-by-wire. The increased power supply capability will also allow fully active suspension systems (with very large power requirements) to be implemented on the vehicle.

Brake-by-wire systems are likely to be introduced in phases, with hybrid systems first. Already the GM EV1 has a hybrid braking system using both hydraulics and electric motors.

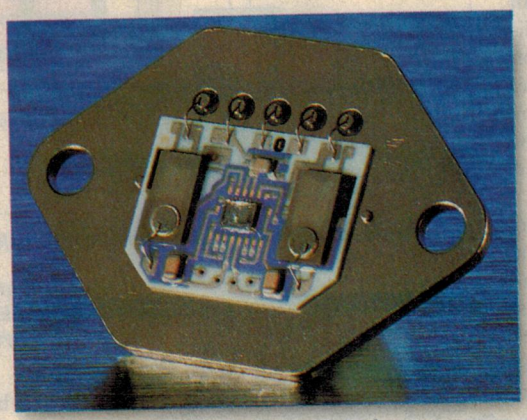
Another system sometimes referred to as 'brake-by-wire' is an entirely hydraulics-based system, but with no mechanical connection from the brake pedal to the master cylinder. This type of system is shown in Fig.3. Pedal position sensors are used to detect the driver's intended braking force and synthetic feedback is generated at the brake pedal.

This type of configuration can be used to remove the ABS pedal feedback, although there are divided schools of thought as to whether this is desirable, as this indicates to the driver that ABS is engaged.

Another major challenge facing the brake-by-wire system is the requirement for fault tolerance. In systems where the hydraulics have been completely removed, no independent back-up actuation system exists — this means that rather than employ systems which fail safely, a fault-tolerant (or 'fail-operational') system is required.

Although many clever techniques can be employed to enhance the safety of fault-tolerant systems, the underlying approach is usually to provide redundancy. If nodes or ECU's fail, back-ups must exist which come on-line without destroying existing system integrity. The degree of fault-tolerance and where it is employed is likely to differ from application to application, but it could reasonably be expected that important sensors and controllers are replicated and that certain other components need not be.

Each wheel would have a motor controlled actuator with an associated control circuit. If an individual wheel unit were to fail, the vehicle could still be braked to a stop using the remaining three wheel units (assuming that the control algorithm was intelligent enough to apply to correct brake forces in the correct sequence to maintain lateral stability). As a failure of this type would not be catastrophic, the wheel units would not be required to be replicated. However if the brake pedal position sensor were to fail, this could be catastrophic; so it is likely that at least one redundant sensor would be added to this part of the system.



A hybrid two-channel acceleration sensor of the type used in current airbag activation systems. (Courtesy Robert Bosch Australia)

The enabling technologies required before brake-by-wire becomes mainstream are thus an enhanced vehicular power management system and a cost effective fault-tolerant architecture. It will also be a major manufacturing infrastructure shift in the industry, to migrate to an entirely electrical solution from a mainly mechanical/hydraulic solution. This will open the market to new competitors which can adapt quickly to changing requirements without the legacy of a huge mechanical/hydraulic support business.

From a semiconductor standpoint, the enabling technologies for conventional electronically controlled braking systems and brake-by-wire systems are very similar. The major differences are the employment of fault-tolerant technology and motor control technologies.

Motors are used in electronically controlled braking systems today, to drive pumps and even hydraulic actuators in some instances. Replacing the hydraulic wheel cylinder actuators with motors should present no significant challenges from an implementation standpoint. Fig.4 illustrates a possible configuration for a brake-by-wire system.

The automated highway

IN EVERY REGION of the developed world, there is a strong interest in the concept of the 'Automated Highway'. The automated highway is an extension of the object detection and collision avoidance concepts, along with further safety system technologies.

Automated highway systems are basically the combination of vehicular systems and 'infrastructures'. The simplest infrastructures are based on on-road beacons (usually magnets) which signal at regular distances to a vehicle mounted system in order to provide position information. Such systems have

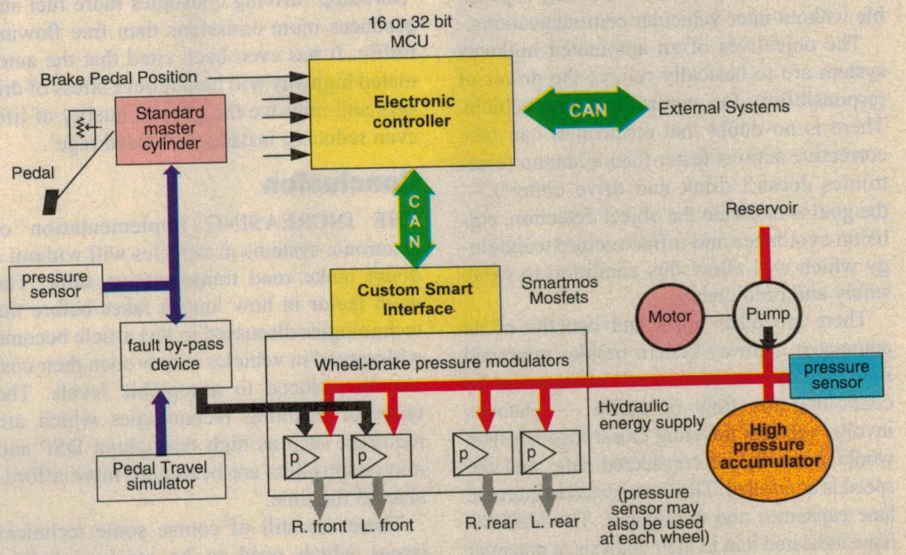


Fig.3: A 'brake by wire' system of the intermediate type based on hydraulics, but using pedal sensing rather than a direct line from the master cylinder.

been demonstrated successfully in both Europe and the United States. Although the concept is simple, it would be expensive to install and maintain this type of infrastructure over an extended geographical area.

Another infrastructure technology which the automated highway could use is the Global Positioning System (GPS). As with the road beacons, this would require additional vehicular systems such as a navigation system (which contains information on the road networks) and sensors (or combinations of sensors). The main drawback today of using such an infrastructure is the restricted accuracy of commercial GPS.

Automated highway systems are also planned to employ a controlled intelligent cruise control system which will allow 'convoy driving' or 'platoons'. A platoon in this sense is a stream of vehicles which travel with close separation along a section of highway equipped with an infrastructure. The communications between the vehicles are analogous in this case to the hardware coupling between train carriages.

This was successfully demonstrated in August, 1997 along a 12 kilometre stretch of highway in San Diego, California, by the National Automated Highway Consortium (NAHSC). This road has been developed further with embedded high-strength ceramic magnets at four feet intervals at each side of the traffic lanes. The estimated cost for creating the infrastructure in North America is US$10,000 a mile.

Although it is expected that communications between vehicles in platoons will be required to achieve stability and optimal vehicle spacing, it has been shown that if all radar, throttle and braking components have been designed correctly, dynamic stability is possible without inter-vehicular communications.

The objectives of an automated highway system are to basically relieve the driver of responsibility for controlling the vehicle. There is no doubt that electronics can take corrective actions faster than a human (electronics doesn't drink and drive either!) — the goal is to create the object detection, collision avoidance and infrastructure technology which will allow this condition to exist, safely and predictably.

There are other goals and benefits of an automated highway system besides improved safety. Traffic congestion will be improved by controlling the flow of traffic — platoons involve vehicles traveling closer together than would normally be considered safe, and the speed is controlled. This is expected to increase lane capacities and throughput. The NAHSC have indicated that in their analysis, a potential exists to triple the capacity of a conventional freeway lane.

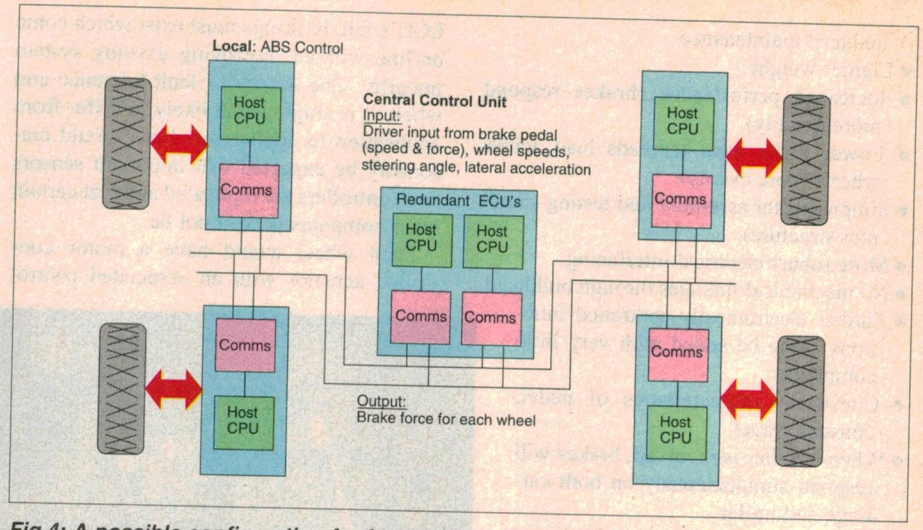
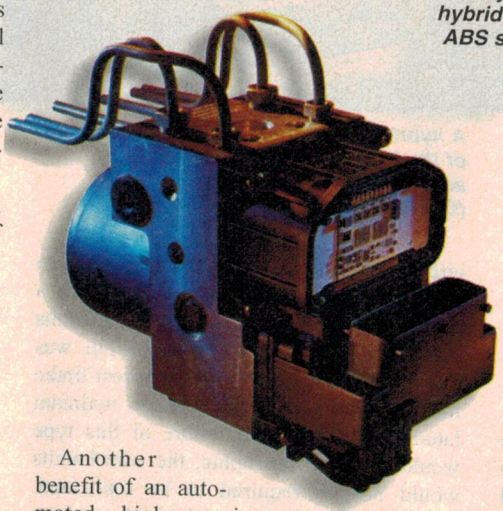


Fig.4: A possible configuration for future all-electronic brake by wire systems.

A hydraulic pressure modulator with integrated hybrid ECU, as used in current passenger vehicle ABS systems. (Courtesy Robert Bosch Australia)



Another benefit of an automated highway is an improvement of energy consumption and reduction of pollutants expelled into the atmosphere by traffic. This would be so as 'start-stop' driving consumes more fuel and produces more emissions than free flowing traffic. It has even been cited that the automated highway will help relieve stress of drivers and improve the general quality of life, even reducing instances of 'road rage'.

Conclusion

THE INCREASING implementation of electronic systems in vehicles will without a doubt make road transportation safer. The main factor in how long it takes before the technologies discussed in this article become widespread in vehicles is how soon their cost can be reduced to acceptable levels. The types of enabling technologies which are required, such as high throughput DSP and microcontrollers are becoming more affordable all the time.

There are still of course some technical issues which need to be resolved before widespread adoption of advanced safety systems is possible. The human interface between the system and the driver in many of these systems such as collision warning is clearly very important. When a warning has to be given to the driver, his reaction must be to safely maneuvre the vehicle from a hazard. Therefore the warning must be designed to provoke this response in the driver without startling him. Often, these types of solutions are more difficult to optimize than pure engineering problems where more tangible trade-offs usually exist.

As in the case of ABS systems, there is also a concern over 'risk compensation' behaviour by the driver. The theory behind this concern is that drivers will drive less attentively under the impression that an advanced safety system will get them out of trouble.

In certain studies, this false sense of security has been shown to be true when vehicles are equipped with safety enhancing systems. Under these circumstances, the system must be regarded as a safety hazard, rather than a safety enhancing feature. There are now several major efforts underway to improve the level of driver education with regard to ABS systems; this must be considered prior to the introduction of more advanced systems such as collision warning and avoidance technology.

History has shown us that if the perceived advantages are great enough, technical difficulties are always resolved and costs are always forced down to affordable levels. The human interface problems with safety systems are clearly very important, as there does not appear to be any significant showstoppers in driving down the costs of the enabling technologies. Perhaps the extra costs that may be incurred when purchasing a vehicle equipped with these advanced systems will be offset by a much reduced insurance premium! ❖

MicroGram Computers

100Mbps Network Starter Kit

This kit comes with all the hardware components required to build a 100Mbps network for two PC's as well as a comprehensive installation manual. All software is part of Win 95/98/NT. The 100Mbps Network Starter Kit provides the most cost-effective solution for users who desire fast throughput at the cost of traditional 10Mbps. The kit includes one 4 port 100Mbps Fast Ethernet hub, two 10/100Mbps PCI Fast Ethernet adapters, two 5 metre Cat. 5 network cables and software drivers for the adapters.

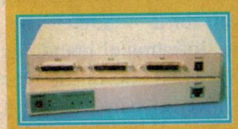
Cat. 11900 **100Mbps Network Starter Kit** $339

Internet Access Server

Internet for everyone! Give all stations on your network simultaneous access to the Internet through this access server. Hardware based firewall ensures your security, while dial on demand minimizes your connect time. It has a built-in DHCP server & includes software to provide clients with their own email address. This pocket-sized Internet-Sharing device provides one communication port (DB25) for Internet access and one RJ-45 port for connection to your 10Base-T Ethernet network. Supports easy Internet connection to your Internet Service Provider via modem or ISDN.

Cat. 10100 **Internet Access Server** $499

10/100Mbps 3 Parallel Port Print Server



Up to three printers can be connected simultaneously with this three parallel port 10/100Mbps print server. Designed with auto-sensing dual-speed capability it auto detects the speed of the network, i.e. 10Mbps or 100Mbps. Built-in TCP/IP and IPX protocol support for Windows 95, Windows NT, NetWare and UNIX is provided along with built-in web management capability and flash memory. DHCP server support automatically assigns IP address.

Cat. 11293 **10/100Mbps 3 Parallel Port Print Server** $519
Cat. 11288 **10Mbps 1 Parallel Port Print Server** $269

10/100Mbps Ethernet Cards

Able to auto sense either 10Mbs or 100Mbs operation, this PnP PCI Ethernet card uses the Bus Master architecture to maximise throughput.

Cat. 11282 **Ethernet Card PCI UTP/STP 10/100Mbps** $59
Cat. 11271 **Ethernet Card PCI BNC UTP/STP** $39
Cat. 11272 **Ethernet Card ISA BNC/UTP PnP Jmp** $39

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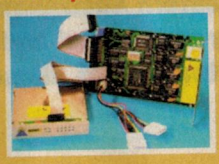
100Mbps Ethernet 5 Port Hub Card



Mounts on the back plane of a computer but does not plug into a slot, it only connects to the power supply. No separate case and power supply means reduced costs, plus everything is kept neat & tidy inside the computer.

Cat. 11294 **Ethernet Hub Card 5 Port UTP 100Mbps** $259
Cat. 11287 **Ethernet Hub Card 5 Port UTP 10Mbps** $89

10Mbps Ethernet 5 Port Hub & LAN Card

Internal PCI Plug & Play 5 Port hub and LAN card does not require external power supply and is a cost effective solution for SOHO users. One port can be used as an uplink port for easy expansion, or used for hub connectivity at the server.

Cat. 11295 **Ethernet Hub & LAN Card 5 Port UTP 10Mb** $109

Serial Cards

We have a large range of serial cards providing either 1, 2, 4 or 8 ports. Our most popular and versatile single, dual & four port cards feature high speed 16550 UARTS, COM 1 to 8 and IRQ 3 to 15.

Cat. No. 2297 **1 Port RS232 16550 COM1-8, IRQ 3-15** $80
Cat. No. 2239 **2 Port RS232 16550 COM 1-8 IRQ 3-15** $99
Cat. No. 2326 **4 Port RS232 16550 COM 1-8 IRQ 3-15** $295

The dual port card is now available with 16650 UART chips with 32 byte FIFO buffers.

Cat. No. 2333 **Two Port 16650 Serial Card** $159

Plug & Play PCI models also available.

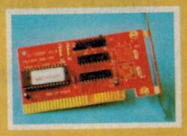
Hard Disk Drive Duplicators

These hard disk drive duplicators offer a low cost, high performance solution whether you want high-volume 1 master to 8 drive copying or quick, low volume, 1 master to 2 drive copying. Features include:

- FAT32 compatible
- Track by track, file by file, whole or partial drive copying
- Accepts different geometry drives including 2.5" and 3.5" drives
- Copy Win 95 / 98 operating systems in minutes

Cat. No. 6426 **Hard Drive Duplicator Two Drives** $2899
Cat. No. 6427 **Hard Drive Duplicator Eight Drives** $6499

Year 2000 BIOS Card



Even Pentium motherboards are not immune to the Year 2000 bug! The Year 2000 BIOS Card solves the problem of progression from 1999 to 2000 as well as 21st century leap years. It is an 8-bit card which provides year 2000 support for motherboards with a BIOS which only stores the year with two digits. i.e. 97 instead of 1997.

Cat. 3359 **Year 2000 BIOS Card** $129

Video Conferencing Kit

A high performance PCI full-motion video/still image capture solution for video conferencing on the net! The kit includes video capture card, CCD camera & VDONet's video conference software. Ideal for applications such as Video Mail, Video Conferencing or Full-Motion Video Capture to AVI file format.

Cat. No. 3356 **Video Conferencing Kit** $299

Watch-Dog Timer

By adding a timing reset instruction to the outer loop of your program, this card will apply a hardware reset to the computer in the event of a lock up. Utility software included for DOS, Windows 3.1, Win 95, Windows NT, OS/2 & UNIX.

Cat. No. 17044 **WatchDog Timer Card** $139
Cat. No. 17050 **WatchDog Timer II Card** $349

Omni-Directional Laser Scanner

An affordable, vertically mounted, Omni-Directional laser scanner, which is ideally suited to reading bar coded products at supermarket checkouts. Performance is higher than the "Name Brands" with a 24 scan line pattern (competitors' products are 20) and 2,400 scans/sec (competitors': 2000 scans/sec). The depth of field is 300mm and it is available in either KB wedge or serial models.

Cat. No. 8521 **Bar Code Laser Omni-Direct. KB Wedge** $2119
Cat. No. 8573 **Bar Code Laser Omni-Direct. Serial** $2119

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Reader Info No. 6

Clearance treasures from Allthings

Many of our readers may not be aware that in addition to its main product lines (video cameras and CCTV systems), Western Australian firm Allthings Sales & Services also offers a variety of 'surplus' and 'clearance' items, at bargain prices. For the experimenter with a limited budget, these can be a veritable treasure trove...

by Jim Rowe

BACK IN the distant past, when I was still at school and just starting to get keen on electronics, my pocket money simply wouldn't stretch to buying many components 'new'. Instead, like most young enthusiasts I haunted the 'disposals' stores, with their treasure troves of bargain priced war-surplus equipment. Some of it was still in the condition it had left the factory, sealed in the original packing. My first home-brew scope was made largely from parts salvaged from a disposals radar display unit, as was my first TV receiver.

Sadly, most of the old disposals stores have long gone. But today's cash-strapped experimenters can still find similar bargains if they hunt around, especially in the 'surplus' and 'manufacturer's distress stock' clearance bins at some of the electronics retailers. (Jaycar stores often have such bargains, for example.)

Of course for those who must rely mainly on mail order, this type of purchase isn't as easy. Happily, though, some of the firms who specialise in mail order do still offer 'clearance bargain' lines. Back in the February issue Peter Phillips described some of the goodies available from Sydney firm Oatley Electronics, and in this article I'm going to reveal some of those available from another of our regular advertisers specialising in mail order: Allthings Sales & Services, of Westminster in WA.

Now you probably think of Allthings as a supplier of video camera modules and closed-circuit TV systems, and these are certainly their main lines. However as it happens they also stock quite a few interesting surplus and manufacturer/importer 'clearance' lines, which are available at attractively low prices.

So that we could tell you more about these 'clearance bargains', Allthings manager Kevin Forknall sent us a box of samples. Some of these are shown in the photos, but I'll now try to give you the details.

By the way, the prices quoted do not include packing, postage or insurance. They also assume payment by mail order or cheque; Allthings add a 3% surcharge for credit card purchases.

The other thing that probably should be stressed is that with some of the lines concerned, stocks are limited and may not be available for long — especially at the prices concerned.

The IR cordless stereo phones, carrying the Infratronic brand. All you'd need to get them going is a 15V/300mA DC supply and a couple of AAA rechargeable cells...

IR cordless phones

CORDLESS HIFI headphones using either infra-red (IR) or VHF/UHF radio links have been around for a while as consumer items, although they never quite seem to have 'taken off' — perhaps because they tend to be fairly pricey. Typically the mono variety tends to cost around $100/pair, while stereo units can cost up to $180/pair.

Ironically these cordless headphones can be just the shot, if you need to move around while you're listening. So if you'd like to try them for yourself, and have only been put off by the price, one of the Allthings clearance items should be of special interest to you. It's a set of IR-linked stereo cordless phones, for only — wait for it — $30.

Carrying the 'Infratronic' brand, the units are neatly styled and of the type intended to have a pair of AAA rechargeable cells in the headset, with a recharging circuit built into the IR transmitter 'stand'. Power to run the transmitter and battery charging circuit comes from a 15V/300mA DC plug-pack or similar supply.

Neither the plug-pack nor the AAA rechargeable cells are included, but the sets are otherwise complete. The transmitter unit has an audio input cable terminated in a standard 3.5mm stereo plug, to connect to your amplifier, CD player or computer sound card, and each headphone has an individual volume control for listening convenience. There's a power switch on the transmitter unit, an 'Off-Charge-On' slide switch on the headset, and also an adjustable band for comfort. Pretty good value for $30, wouldn't you agree? Similar units would normally cost you well over $100.

Incidentally Allthings also seems to have 240mAh rechargeable AAA NiCads available, of the type you'd need for these headphones, at $4 for a pack of two.

Battery regenerator

BATTERY 'REGENERATORS' have become popular in recent years, and although there's been a lot of debate about their effectiveness in boosting the life of alkaline and heavy-duty zinc-carbon cells, they can often be used as chargers for NiCad cells as well. So a regenerator kit for only $15 should be of interest to many experimenters — especially when it includes a 9V/500mA DC plug pack, which would normally cost you around $15 for a start!

For this price Allthings is offering a Greencell RMK1 'Mini' Regenerator, originally marketed by Ring-Grip, which is claimed to extend the life of alkaline cells by up to 10 times, and that of heavy/super heavy duty cells by up to three times. It's designed to take up to four AA or AAA cells at once, and can also recharge NiCads of the same sizes — with individual LED indicators. Switches on the side are used to set it for the different battery types and regeneration/charging modes, and it comes complete with instruction booklet.

9V batteries

WHILE WE'RE still on the subject of batteries, Allthings can also supply a box of 10 Greencell 1604G 'extra heavy duty' 9V batteries (standard 216-type), for only $8. The batteries are new, still in their original blister card packaging, and have an expiry date of December 1999.

Ten for $8 seems good value, when similar 9V batteries typically cost around $3 each...

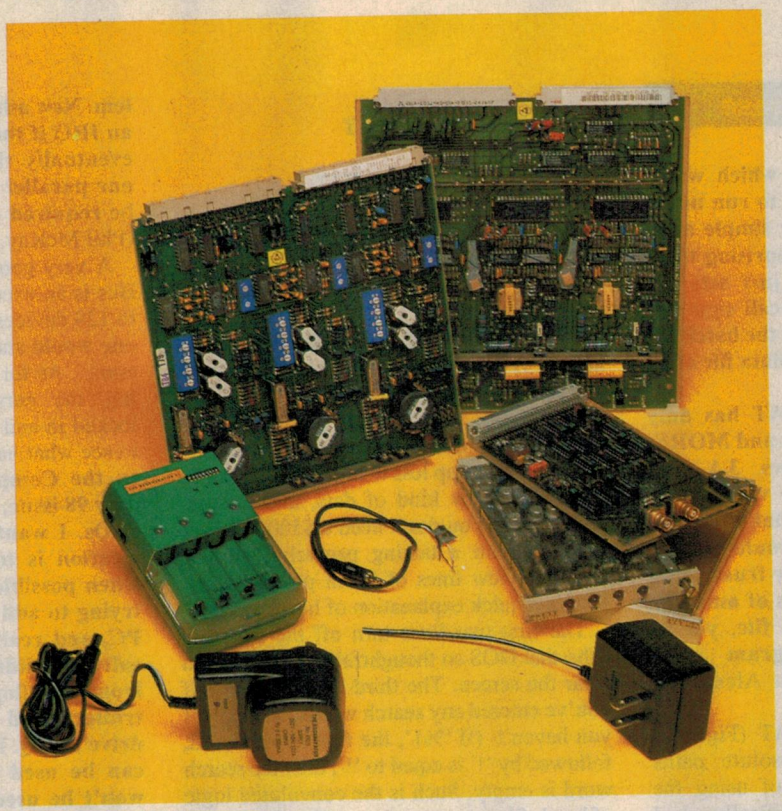
Smaller items

MOVING ON, there are some smaller items you might find interesting too. For a start, Allthings apparently has a large number of digital watch inserts — the kind with an alphanumeric display in digits 7mm high, alternating between the time and the date. They measure 25 x 25 x 3mm, and run from a 'button' cell about 4mm in diameter. Complete with tiny quartz crystal, they're on offer for only $5 for a bag of 10 — great for making novelty brooches, etc.

Then there are 3.5mm stereo jack plugs, of the moulded variety and complete with leads about 350mm long, with each of the three conductors bared and tinned at the end — and even labelled 'tip', 'ring' and 'barrel'. They'd be fine for attaching captive output leads to audio gear, etc., especially at the quoted price of only $5 for a bag of 10.

Or how about a set of Walkman-style 'in ear' stereo phones, made by Sharp (RPHOE 0104PFZZ) and complete with lead and moulded-on 3.5mm plug. Allthings have them at three for $5 — you'd normally pay more than this for a single pair.

Then there are some plug-pack power supplies, but of the 'overseas' variety — either 220V types with two European/Asian style round pins, or 120V types with two flat parallel pins as used in the USA. They could be of interest if you're travelling, or in the case of the 220V types just to adapt for use inside projects.



Some of the other interesting items. The Greencell battery regenerator/charger is at lower left with its plug pack, while some of the large and small ex-Telecom PCBs are at the rear and centre right respectively.

For example there's a Grundig 220V to 15V/150mA *regulated* DC supply with round pins, complete with output lead and tiny two-pin output plug for $3. What makes this one interesting is that the complete internal PCB assembly is easily removable from the screw-together case, and could be mounted inside a case without much difficulty. It even has a replaceable thermal cutout, so could probably be used on 240V without risk.

A similar (but sealed) round-two pin 220V type with 24V/700mA AC output with lead and standard concentric output plug, made in Taiwan, is available for $5. There's also a 120V type (two flat pins) with a 12V/750mA AC output and short (150mm) output lead without connector, at $10 for a bag of 10.

Ex-telecom PCBs

FINALLY, BUT by no means least, Allthings have apparently been able to acquire a significant quantity of outdated but essentially new-condition high quality printed circuit boards, which look as if they were manufactured by firms like STC and Siemens for use in telephone exchanges and long-distance switching setups. They're professional grade PCBs, mostly in the original packaging as supplied to Telecom from the manufacturers; they must have cost hundreds of dollars originally.

There seem to be two main types, one about 210mm square and relatively 'open', and the other about 170 x 100mm and with shield covers on both sides. Each type comes in various versions, with a different mix of active and passive components.

Some boards have more digital chips (generally TTL) than anything else, while others have more analog ICs and discrete parts — including signal and power diodes, low power TO-18 or TO-92 bipolars and TO-126 power transistors. Quite a few have inductors or transformers wound on ferrite pot cores, which could conceivably be used to wind other coils. Many also have plenty of discrete passive parts like resistors, close-tolerance plastic capacitors, monolithic ceramics, TAG tantalums, reed relays, trimpots and trimmer caps, and so on. There are even PCB-mount toggle switches and LEDs, on some boards, and the odd quartz crystal (although for somewhat oddball frequencies, like 12.288 or 13.65333MHz).

Pretty well all of the components are of high quality, and many could be 'released' from the PCBs with a bit of care. For those with the time and motivation to do this, the boards would thus provide a lot of useful parts for experimenting.

And the cost? Well, Allthings is currently offering a box of 10 assorted boards — five of the larger ones and five of the smaller — for only $30 plus P&P.

These are just a few of the interesting clearance items currently available from Allthings. You can order these, or get a listing of their other product lines, by writing to them at PO Box 25, Westminster 6061 or faxing them on (08) 9344 5905. ❖

Computer Clinic

DOS Databases, even more IRQs & a daffy disk drive

Batch file database

Why does my batch file, which works under Windows 3.1, fail to run under Windows 95? I have a very simple amateur radio log program comprising three files — LOG.ANS which just sets the screen with a title and my call sign and name & address, LOG.BAT, the batch file itself, and LOG.DAT — the data file of all my contacts.

As you can see, LOG.BAT has only the two commands — FIND and MORE. I've heard that Windows 3.1 and Windows 95 use different versions of DOS but I did not think that the commands FIND and MORE would change with the new DOS. It is very frustrating to have almost twenty years of amateur radio contacts on the data file, yet be unable to use the program after installing Windows 95 (Ian Alexander, via email)

The problem with LOG.BAT (Fig.1) is that you have specified absolute paths throughout. That is, instead of using the command FIND, you have specifically asked for A:\DOS\FIND. As Win95 replaces the commands in the DOS directory with its own set of commands in the WINDOWS\COMMAND directory, there is no longer a FIND command where you've told it to look. What I recommend you do is to strip off all the paths, as shown in Fig.2. This will allow your system to find the commands by itself, and means that it won't fall over if you move the files somewhere else, about which more later. I've also taken out a couple of lines that turned out to be redundant.

Fig.1: Original LOG.BAT

```
PROMPT $G
CLS
IF %1!==! GOTO EXIT
TYPE A\LOG.ANS
IF %2!==! GOTO PC1
A:\DOS\FIND /I "%1%2"
A:\LOG.DAT | A:\DOS\MORE
GOTO EXIT
:PC1
A:\DOS\FIND /I "%1" A\LOG.
DAT | A:\DOS\MORE
:EXIT
```

Fig.2: New LOG.BAT

```
CLS
IF %1!==! GOTO EXIT
TYPE LOG.ANS
FIND /I "%1%2" LOG.DAT | MORE
:EXIT
```

GUI users, take note of Fig.2. Here we have a fast, simple and efficient database program that takes up less than 100 bytes, can be adapted for any kind of data, and is completely free. You don't need a $500 database program with a talking paperclip; all you need is a few lines of batch programming. Here's a quick explanation of how it works:

The first two lines turn off the irritating echo that DOS so thoughtfully provides, and clear the screen. The third line works out if you've entered any search words, and exits if you haven't. (If '%1', the first search word, followed by '!' is equal to '!', then the search word is empty. Such is the convoluted logic of batch file programming...) The fourth line prints some text to go at the top of the screen. The main workhorse of the program, however, comes in line five. Here, the FIND command is run with any search words entered ('%1%2'; if %2 is empty, it makes no difference...) in LOG.DAT, the database of contacts. The output of the command is piped to MORE, which inserts a pause between pages of results. Line six is just a marker for the exit pointed to by line 3.

Oh, and by the way, I strongly recommend that you copy the files off your A drive onto C:. This will speed the whole process up greatly, and be a lot less prone to errors. Just create a new directory on C: somewhere, such as C:\LOG, and put all the files in there. Then just CD over to C:\LOG, and run your program as usual.

Even more IRQs

A couple of people have written in about the ever-shrinking IRQ pool mentioned in the July issue:

I think USB is the solution to the problem. New add-on devices will not require an IRQ if they connect via the USB, and eventually the standard two serial and one parallel port in a PC will no longer be required — freeing up existing IRQs (Phil McKay, by email)

A very good point. The Universal Serial Bus is an excellent standard, supporting up to 128 devices at a time. Now if only someone would start making some USB peripherals... As for the standard ports disappearing, my personal guess is that they're locked in and there to stay. We'll just have to see what happens.

In the Computer Clinic column in the July 98 issue, there is an item about More IRQs. I want to suggest that a possible solution is to share some of the IRQs when possible. I had this problem when trying to add a tape controller card to a PC, and realised that as the tape drive software didn't allow for access to or from the floppy drives, the tape controller card could share the floppy drive's IRQ. I suggest that this technique can be used whenever two peripherals won't be used at the same time. (Bruce Howells, by email)

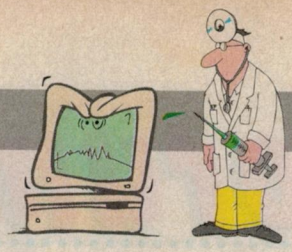
It certainly can, Bruce, and this is an excellent way to save resources. I'd just like to point out, though, that this can lead to some very hard-to-track bugs if the two devices *do* happen to get used at the same time. If anyone out there is thinking of trying this, make sure you know what you're doing, as IRQ conflicts can cause system lockups at really inopportune moments.

Hard drive woes

I have a Pentium II on a 440LX motherboard. My secondary IDE port has a CD-ROM configured as master and the slave is an Iomega Zip drive.

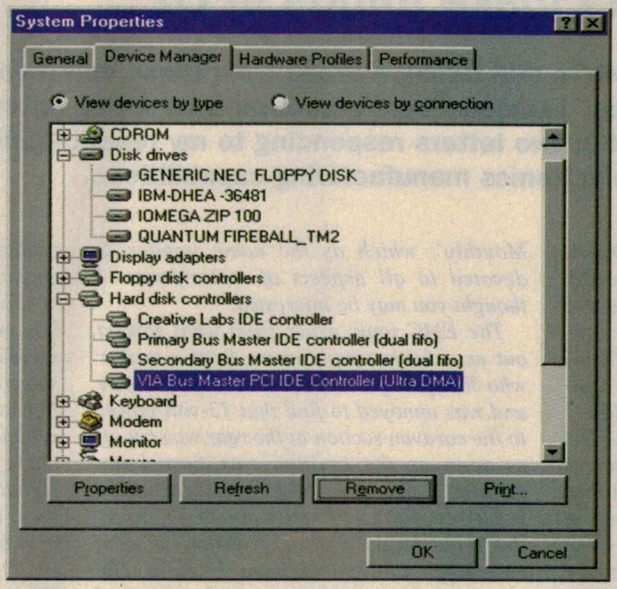
My primary master is a Quantum Bigfoot CY-43 4.3GB HDD and I have no slave. I want to run my 540MB Palladium HDD as the slave but no matter what I do I can't get it to run. My BIOS recognizes it and DOS runs no problems, and in Windows' safe mode I can see it too. But when Win95 starts up the computer either hangs or reboots way before it even

by Jean-Baptiste Cattley



Got any computer queries? Whatever is bugging you, from hardware problems to C programming, send it in and we'll soon have you fixed up. You can email your question to electaus@magna.com.au, or fax or mail it in to us here at EA.

Here's one of the nasty things now. Give it a short, sharp tug, and it should come away quite easily.



makes it close to Windows.

I also need to run an Intel device driver for the mother board Intel 82371 AB PCI bus master IDE controller. The 540MB HDD ran in both the master and slave positions of the secondary IDE port without any problems. None of these bits of hardware will run with the Primary Master HDD. (CD-ROM, Zip Drive or the 540MB HDD.)

I can't seem to find any conflicts and I appear to have enough IRQs to cope with another HDD. I believe the problem is one of Windows drivers — is there any way I can choose them at load up? Pressing F8 and selecting step-by-step only lets you choose in the config and autoexec files and then asks if you want to run Windows drivers or not. Can you please help me? (Greg Cockburn, via email)

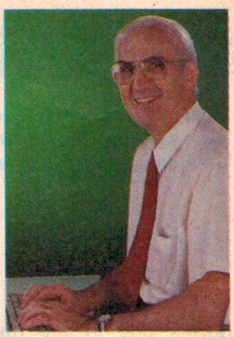
This is definitely weird. As you say, it must surely be a matter of Windows drivers. I have always had bad luck with proprietary IDE drivers, and never did trust the things. Not having your system in front of me to play with, I can only suggest that you try the time-honoured 'brute force' solution that should be familiar to every PC user:

1. Gather together all your driver disks
2. Put your CD-ROM drivers for DOS into your AUTOEXEC.BAT and CONFIG.SYS. (See the March 1998 Computer Clinic column for an explanation of how to do this) and ensure that they work.
3. Go to Device Manager and (gritting your teeth) remove all drives and drive controllers from your system. Win95 will keep asking if you want to restart. Don't let it do so until all the offending devices are gone.
4. Reboot. Windows will now go into a flurry of re-detection. If it asks you what drivers you want for anything, just go with the Windows default ones.
5. Once everything seems stable, (you might give it another restart just to be sure) shut down again and install your Palladium drive on the primary slave.
6. Start up again. With any luck, everything should now work.
7. To get optimal performance from your system, you can now start reinstalling proprietary drivers. Restart after each one you install, and see if the problem comes back. If it does, you know which one is causing the problem, and you should be able to remove it from the Drivers|Change Driver tab of its properties in Device Manager. To replace it, just select the most generic-looking one from the list of compatible devices.
8. Get in touch with the creators of said driver and complain!

Good luck! ❖

Forum

Conducted by Jim Rowe



Motorhome safety and EMC in Europe, and WHY we can't make things in Oz...

This month we're still taking a break from those controversial 'alternative electrotherapy' devices. There's another interesting letter from a reader in England, plus the first of two letters responding to my recent leader lamenting the demise of Australia's electronics manufacturing capabilities...

YOU MAY RECALL that in the March column I published a letter from reader Paul Coxwell, who lives in England. Mr Coxwell was commenting then on auto-transformer safety, and also on the difficulties of establishing and maintaining a business, especially in the electronics industry.

Well, Mr Coxwell has written again, this time with some more interesting comments on electrical safety, and the trials and tribulations resulting from EMC regulations in Europe — specifically in connection with motorhomes. He also tells the tale of a novel, though incredibly dangerous, electrical installation discovered at a caravan park in France. Here's his letter:

Greetings once again from England and the small settlement of Eccles On Sea. By the way, I liked your comment about the name sounding like something out of the 'The Goon Show'. I guess it does sound a little strange, but then names like Wollongong and Wagga Wagga always raise a laugh over here!

I hope you will forgive what may turn out to be a long missive, but I have some comments about several items and I might as well get my money's worth for the overseas postage.

You may recall the rather dangerous auto-transformer setup that we discussed some time ago. I recently received a new catalogue from a US mail-order company, and I noticed that the same units are still being sold over there. Enclosed is a copy of the appropriate page: The two sockets are clearly visible, and although the connecting flex is not pictured, there is a rather interesting description of it as a 'Special power cord'. Special indeed: a plug at each end!

Electromagnetic compatibility has been the subject of considerable recent discussion in Forum. Interestingly, I have been following another EMC discussion over the last few months, which has been raised in the UK journal 'Motorcaravan & Motorhome Monthly', which as the name implies is devoted to all aspects of motorhomes. I thought you may be interested.

The EMC topic arose from what started out as a fairly simple query from a reader who had just purchased a new motorhome and was annoyed to find that 12-volt power to the caravan section at the rear was cut off as soon as the ignition was turned on. Naturally, this prevented anyone travelling in the rear from using the radio or TV, using the pump to get a glass of water, or even switching on a light while on the move. The gentlemen in question correctly surmised that a relay was responsible for cutting off the caravan power, and wanted information on how to bypass the relay...

Several letters followed from other owners, dealers, and so on, some suggesting that the cut-off relay was there for a reason and should not be bypassed, others simply looking for an explanation as to why the relay was fitted to some models and not others. Eventually, one motorhome company came up with an explanation.

To summarize, it appears that the problem is with the difference between 'CE' approval marks for domestic equipment and 'e' approval for automotive equipment. The latter is apparently supposed to indicate electromagnetic compatibility, to the extent that equipment so marked will not cause any problems with computerized ABS braking, engine management, air-bag systems etc.

Having read the explanation, my reaction is a mixture of cynicism and alarm. Are we seriously being expected to believe that something as simple as a 12V incandescent light with a built-in switch could affect the vehicle's microprocessors? The whole vehicle is full of such circuits (brake lights, turn signals, etc.), which by their very nature have to be used while on the move. These now have to have an 'e' approval, but there really isn't much one can do with a simple filament lamp to justify the granting of the mark for a tail-light and the refusal for an interior light!

Ludicrous directives

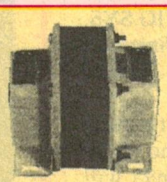
The cynic in me suggests that most technicians don't have any real concern about EMC problems with radios, lights, etc., but that the manufacturers are being overly cautious when dealing with EU directives and approvals. Australians have been spared the full force of EU bureaucracy, which in recent years has run riot with ludicrous restrictions and directives, some of which defy all rational reasoning.

Are the manufacturers just trying to avoid possible litigation, however remote, by preventing the use of equipment on the move which has not received the 'e' approval by our EU lords and masters?

If there really are genuine concerns about EMC problems, then I would venture to suggest that the microprocessor units are dangerous, since they are obviously not up to the task in hand. Suppose that these units really are so sensitive that slight interference from, say, the water pump motor can affect them. What happens if the brushes on the heater motor wear and start sparking a little, even though the latter has 'e' approval because it must be used whilst in motion? What happens when driving past a transmit-

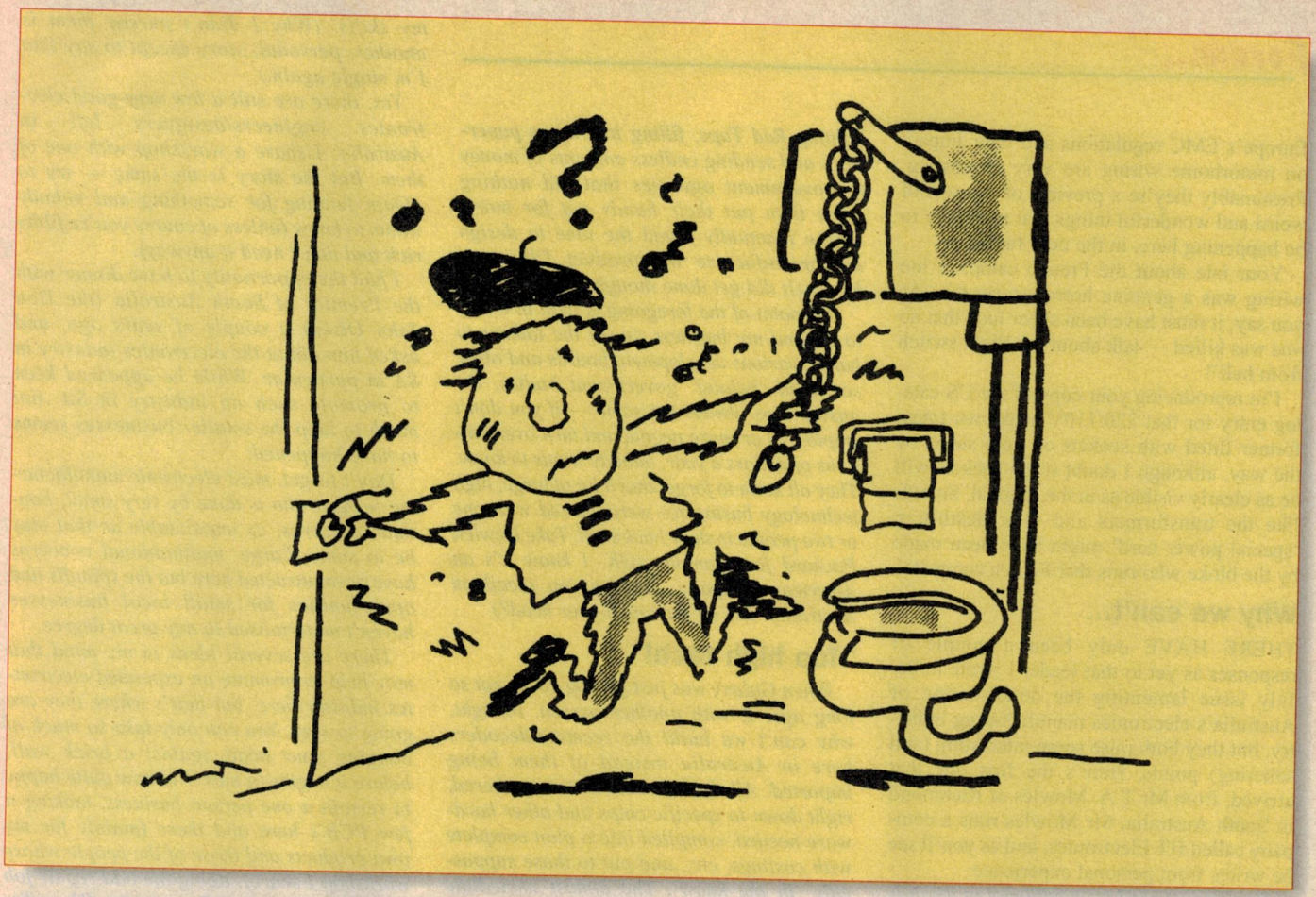
110 VAC, 220 VAC Converters

Convenient transformers allow user to utilize 110 VAC appliances in countries that have 220 VAC power and vice versa. Special power cord is included.



Part #	Watt Rating	Dimensions	Net Weight	Price (1-9)	Price (10-UP)
120-800	200	4" x 2-5/8" x 3-1/4"	4 lbs.	$22.50	$19.95
120-810	500	5-1/8" x 3-1/4" x 3-7/8"	8-1/2 lbs.	43.90	40.80
120-820	1000	5-1/4" x 4" x 4-3/4"	12-1/2 lbs.	59.90	56.50

The excerpt from a US electronics catalog sent by Paul Coxwell. The transformers do indeed need a 'special' power cord, being fitted with sockets for both the 220V input and 110V output!



ter, that induces a voltage in the wiring 10 times greater than that likely to be obtained from a portable TV set operating in the back of the vehicle? The letter from the motorhome technical department acknowledges that this is a very real possibility...

I do not want to believe that designers would be so careless and negligent as to allow the use of computerized systems that cannot withstand a small amount of electrical noise from relays, motors, fluorescent lights, and so on. I think that the problem with strong RF fields, however, has been clearly proven. There is no way I would ever want such susceptible systems in charge of central locking, braking, or any similar task. Perhaps I am fortunate in having a dislike of modern vehicles, so I never have the misfortune to come across such problems.

Another topic raised fairly regularly in 'MMM' is that of reversed live (active) and neutral connections, particularly on Continental campsites. Many European sites use the domestic type of plug and socket: Although the earth connection is clearly defined, the position of the live and neutral connections are not, since the plugs are reversible. I understand that in many European countries it is standard practice to use double-pole switching and fusing. This can cause problems for UK motorhomes, and many people carry a polarity tester to ensure that they connect up the right way round and so have the vehicle's switches and fusing in the live side of the circuit.

Some Continental sites use the industrial-type CEE 16-amp connector, as used on most UK sites. These do have the live and neutral positions defined, but many Europeans are not too careful about observing the correct connections, so most UK visitors to Europe carry a short adapter lead with suitably crossed wiring, just in case...

I would like to move on now to your June editorial comment about Mr Carter's business on The Gold Coast. I saw the advertisement, and was actually tempted to make further enquiries. I decided against, however, on the grounds that (a) I would probably not be considered experienced enough, since my TV work at Goonhilly was some time ago and I have not kept up with current domestic developments, and (b) that with such a good offer there would be no shortage of Australian applicants, so someone from the other side of the world wouldn't stand a chance.

I find it incredible that Mr Carter received no enquiries whatsoever. If a company cannot get applicants at $1000 per week on the Queensland coast, what must the situation be like for establishments offering more modest salaries in more remote areas? I am tempted to re-consider and look toward Australia for possible future employment.

Finally, I thought you might be horrified, if not amused, at another tale from the Continent. It appears that the owner of a French campsite wanted to save electricity by having the light of the WC linked to the door. A job for some kind of microswitch, you might think, but this chap decided he could save a few francs by wiring up the two sections of the door bolt as a switch! Apparently this potentially lethal set-up had been in use for quite some time until an unfortunate visitor happened to reach for the bolt before letting go of the chain. (I gather he survived.)

How this ingenious piece of engineering went undiscovered for so long is a mystery: Perhaps everyone had been wearing well-insulated shoes, or the main section of the bolt was wired to the mains neutral. I think my suspicions would have been aroused at the light going on as the bolt made contact with its plate on the doorframe. I'd say the owner was extremely lucky that nobody was killed by his stupidity.

Thanks for another entertaining letter, Paul, and I'm glad you didn't take offence at my comment about the name of your town. I certainly agree that we have a few interesting placenames here too — like Yackandandah (Vic), Muckadilla (Qld) and Gulargambone (NSW). I suppose your town's name just rang a bell, for someone who grew up with the Goon Show!

Anyway, Paul, your comments about

Europe's EMC regulations and their impact on motorhome wiring are very interesting. Presumably they're a preview of the sort of weird and wonderful things that are likely to be happening here, in the near future.

Your tale about the French campsite loo wiring was a genuine horror story, too. As you say, it must have been sheer luck that no one was killed — talk about the 'light switch from hell'!

I'm reproducing your copy of the US catalog entry for that 220/110V stepdown transformer fitted with sockets on both sides, by the way, although I doubt if the sockets will be as clearly visible as in the original. Sounds like the transformers and their death-trap 'special power cord' might have been made by the bloke who runs that French campsite!

Why we can't...

THERE HAVE only been a couple of responses as yet to that leader I wrote in the July issue lamenting the deterioration of Australia's electronics manufacturing industry, but they both raise some interesting (and sobering) points. Here's the first one that arrived, from Mr T.A. Mowles of Richmond in South Australia. Mr Mowles runs a company called HT Electronics, and as you'll see he writes from personal experience:

Having just read your editorial in the July issue of EA, I have to agree with your sentiments.

I run a small (one person) business that has, over the years been involved in repairs (everything from electronic toys like games machines and radio controlled cars to TV, video etc., and now automotive equipment like analysers, wheel aligners and balancers), manufacturing printed circuit boards for hobbyists and small-run prototypes and manufacturing electronic products.

Several years ago I was involved in manufacturing specialist receivers and decoders for the narrowcast market, and was in a position to employ somebody. All I can say is, never again. I seemed to spend more time fighting Red Tape, filling in endless paperwork and sending endless amounts of money to government agencies that did nothing more than put their hands out for more. Where I actually found the time to design and manufacture the product I'll never know. (It did get done though!)

The point of the foregoing is that, in trying to expand my business, in all the talking to banks, various development boards and other so-called 'helpful' government bodies, the answer was always the same — if you don't employ 10 or more people and turn over millions of dollars a year, nobody wants to know. They all seem to forget that a lot of large, high technology businesses were started with one or two people in their back shed. Take Hewlett Packard for example. (OK, I know it's an American company, but can you recall an Australian one off the top of your head?)

"Too high tech!"

When Galaxy was just getting going not so long ago, I, with another person, thought, why can't we build the receiver/decoders here in Australia instead of them being imported. All the information was gathered, right down to specific chips and other hardware needed, compiled into a plan complete with costings, etc., and put to those supposedly 'in the know'. The almost immediate response was "It's high tech for Australia and can't be done here".

After that I just gave up. If the 'money men' and other 'high ups' have that sort of attitude towards anyone trying to setup a high tech business in Australia, there seems absolutely no point in lamenting the lack of a substantial electronics industry in this country.

All of the smart entrepreneurs and electronics engineers/designers have gone where they are better appreciated — overseas. I know, because I went to the UK in 1996 for family reasons and the electronics industry there is (was) the fourth largest in the world; very little digging was needed by me to unearth various opportunities for my skills. (Why I didn't pursue them is another, personal, story except to say that I'm single again.)

Yes, there are still a few very good electronics engineers/designers left in Australia; I share a workshop with one of them. But the story is the same — try to obtain funding for something and nobody wants to know (unless of course you're filthy rich and don't need it anyway).

I had the opportunity to have dinner with the Premier of South Australia (the Hon John Olsen) a couple of years ago, and asked him about the electronics industry in SA in particular. While he appeared keen to promote such an industry in SA, not much to help the smaller businesses seems to have happened.

Don't forget, most electronic manufacturing in Australia is done by very small, boutique concerns, as unpalatable as that may be to some. Large, multinational concerns have been attracted here but the spinoffs and opportunities for small local businesses haven't materialised to any great degree.

There are several ideas in my mind that may help to promote an expanded electronics industry here, but that's where they are going to stay. You can only take so much of banging your head against a brick wall, before it begins to hurt. I'm now quite happy to remain a one person business, making a few PCB's here and there (mainly for my own products and those of the people whose workshop I share), doing the odd repair job and manufacturing Temperature/Humidity sensors and various other add-ons for a computerised greenhouse environment control system (conceived and designed here in SA). It may not make me rich, and some will say it's a defeatist attitude, but at least I can sleep peacefully at night.

In short, and in reply to your question 'Why CAN'T we do it HERE in Australia?', nobody really wants to know and those that do don't really care either way. Remember the old Australian tall poppy syndrome — stick your head up (or your hand) and you're guaranteed to lose it real quick.

Hmmm — thanks for your frank comments, Mr Mowles. I'm sure they will seem unduly pessimistic to some, but I suspect your evaluation of the overall situation is pretty accurate. There doesn't seem to be much real interest in, or committment to fostering an Australian electronics manufacturing industry, does there? Many of the firms we *had* in the industry seem to have either been closed down, or swallowed by multinationals, or both. And again, no one seems to care.

You can see why it really hit me when I visited a bunch of firms in California!

That's probably all we have space for this month. I'll save the second letter commenting on local manufacturing until next time, plus another one with some interesting comments about G-code and DVD videodiscs. I hope you'll join me then. ❖

MARKETPLACE

Serviceman

Bugged by faults of the six-legged kind!

You've heard of 'bugs' in software, and a few months ago we had a story about a hardware 'virus'. But here's another couple of stories about electronic faults linked to bugs of another kind — the perambulating type with six legs, normally. (Would you call these 'liveware' bugs?) There are also some enjoyable reminiscences from a reader who admits he trained in the 'calibrated screwdriver' era...

THIS month we start the column with two entomological stories. And if you are wondering how the study of insects ties in with electronics, just read on.

The first yarn comes from John Smyth, of Graystanes in NSW. John doesn't tell us about his background, in either entomology or electronics, but he is certainly wiser in both fields after this little experience. He calls his story 'A Pain in the Neck (PCB)':

Since I am not very experienced with line output transformers (LOPTs) on TVs, I was happy enough when a focus problem seemed to indicate a straightforward dud line output transformer.

It was a Sanyo CPP6001V and had come all the way from the customer's holiday home on the Gold Coast. They thought one of their tenants had dropped the set, as the cabinet back didn't fit properly...

Anyway, the real problem was a very fuzzy picture which was reported to come good as the set warmed up. Of course it didn't come good for me, no matter how long I left it on test.

I measured the focus voltage and found roughly 1100 volts, regardless of the setting on the focus pot. On checking all the circuit diagrams I have for other TVs, I estimated that I should be expecting at least 4500 volts.

Since the focus voltage comes straight out of the LOPT, and goes straight onto the focus pin of the picture tube, I concluded the transformer was bad. The customer approved the price of the repair, which I found somewhat embarrassing because it was the most expensive LOPT I have ever bought.

When the new unit arrived it was in a different case to the original, but the mounting arrangement was the same. A quick call to the supplier provided the information that such variations in shape are common when a substitute LOPT is supplied.

Thus reassured, I installed the new transformer and everything came up fine. After running perfectly on test for several hours, the set went back to the customer.

Then about two weeks later I had a telephone call to tell me that they had only just now turned the TV on for the first time — and it had the same fault as before!

I couldn't imagine what was wrong, but when I viewed the set in the customer's home I found they were indeed right. What DO you say when the customer asks "Didn't you test the TV before you brought it back to us?"

Luckily, they had not sent it back to the Gold Coast with their daughter because they feared it might be damaged while in transit as excess baggage.

I could imagine only two possible causes for the continued trouble. Either the picture tube had an intermittent short on the focus pin, or the new LOPT had failed.

Measuring the resistance from the focus wire to ground revealed about 100k ohms, instead of infinity as I should have found. When I removed the small printed circuit board from the base of the tube, I was able to clear the tube of any blame as the 100k to earth was still on the focus lead.

Disconnecting this wire from the base PCB cleared the LOPT, because there was then an open circuit between the focus wire and ground.

Unbelievably, the 100k was still measurable between ground and the now completely disconnected focus terminal on the base PCB. I wondered if maybe there was some sort of protection component inside the tube socket itself which had activated and was now providing the 100k leakage path.

When I disassembled the tube socket, I found the totally unexpected answer.

The focus wire runs from its own enclosure into another section, where it is joined by an earth terminal to form a spark gap. And what do you think I found around this spark gap? Ants!

The spark gap compartment was full of the remains of tiny brown ants, about 25 of them. And they were only in this one area! There wasn't a single ant anywhere else in the set...

As I cleaned out the mess, I wondered whether the transformers had been damaged by a short or overload of some kind, or whether the ants were just holding down the focus voltage.

When I put the set back together, I switched on and the picture came up with a perfect picture.

I put the old LOPT back into the set and it too gave a perfect result. Obviously there was nothing wrong with either transformer. And having refunded the price of the (unnecessary) new LOPT, I guess I'm stuck for life with it.

Oh well! As they say, "Win some, lose some".

How about that? Who would have thought of ants as the villains in a focus problem? I would have thought the focus voltage would have vapourised the ants anyway, leaving no trace to short the supply. But then, vapourised ants might leave a conductive remnant behind. I don't know enough about ants to make an informed decision.

John's story reminds me of a tale we reported in this column a year or two back, where small brown ants caused havoc with a newly installed alarm system. In that case the ants were well and truly alive and they were triggering the movement detector. They weren't baked, as in this story.

All the same, John, I can't help wondering if you might not have been over-zealous in replacing the old transformer and refunding the cost of the new one. The old unit had obviously been strained by trying to maintain the focus voltage in the face of a 100k load. Personally, I wouldn't like to guarantee its future reliability.

I reckon I would have told the customer what I had found, then suggest that the new transformer be left in place. Most owners would prefer the extra reliability offered by a new component, against the doubtful state of the old one. After all, they had approved the expenditure for a new component and it would cost them no more to make use of it.

Thanks for that story, John. It certainly reminds us that 'mobile contaminants' should always be considered as a possible cause of any unexplained fault or failure.

One down, five to go

By strange coincidence, a similar entomological story has come in by e-mail from Robin Buchanan, of Seymour in Victoria. In fact, it's a double coincidence because the subject also repeats the theme of one of the stories in the July column, about the clock movement.

Here's what Robin has to say:

Most of my friends know of my interest in electronics, so I'm often handed quite a few non-working machines to fix or destroy. One such 'gift' was a quartz movement clock, which had not been going for about six months.

Upon examination, I saw the second hand making very small movements but not actually moving on. I thought it probably needed a new battery, so I replaced the old cell but that gave no joy.

Being too clever for my own good, I decided that it must have an electronic fault — so I carefully removed the hands and the movement from the clock face and pried open the case.

Out fell an earwig, of which I thought nothing in particular at the time as it quickly ran away...

I got out my multimeter and took some measurements around the circuit board and eventually found that a pulse was being delivered to the little copper coil, about once every second.

I then prodded gently at one of the gears and found that the clock would run for 60 seconds, then stop again. I got out my magnifier and found a tiny black object jammed in the gears.

I extracted the offending object and found it to resemble a minute piece of black stick. After examining it further under the magnifier, I reckon it was one of that earwig's legs! Unfortunately, the insect had not stayed around to be examined.

So my electronic knowledge was wasted on this occasion.

Oh, I don't know Robin — without your electronics knowledge, you would never have been tempted to open the case, and thus you would never have known that an earwig can live six months in a clock movement, then run away on only five of its six legs!

Of course, that sort of knowledge would only ever be of use in a game of Trivial Pursuit, but it made a fun story anyway. Thanks a lot.

At the end of the July item, I suggested that servicemen might take up clock repairs as a sideline. Robin has just reinforced that suggestion. Some such repairs would be money for jam!

Calibrated 'driver

Now we come to a few annecdotes from a confessed 'Old Timer' from Killara, in New South Wales. He is R.M. Halliday, and he has several interesting tales from the days when electronics was an arcane profession inhabited by odd characters given to creating weird noises, loud bangs and bright sparks:

Your stories always interest me and I take this opportunity to pass on a few more.

I have been retired for some 10 years, so electronics is now merely a hobby. In my former position I relied on a combination of professional grade test equipment with home-made interfaces to measure various physical quantities in a hydrodynamics laboratory.

My first story concerns a Philips TV set which is mounted in a nice timber case. The shape is a simple rectangular box and it is provided with a die-cast aluminium undercarriage and castors for mobility. Behind the TV a videotape recorder sits on a fixed shelf. The top of the TV is a very convenient surface for the temporary storage of video cassettes...

Unfortunately some of my tapes have deteriorated in quite a short time and picture synchronism has failed. Then a story in your columns about the poor insulation provided for a degaussing coil around a picture tube caught my attention and 'the penny dropped'. I had been degaussing my video tapes!

Then on a similar subject, the double insulation idea often fails and I nearly ended the career of a colleague with a nasty piece of imported equipment.

The modern PC with a suitable I/O interface has replaced most types of chart recorder, but back in those days a digital computer was a mighty machine with less computing power than a cheap 1998 scientific calculator. Its accompanying recorder used a roll of photo-sensitive paper on which a thin beam of intense light could write. The beam was wiggled from side to side by an oscillating mirror and the chart drive moved the paper at a steady speed so that a graph of the chosen quantity against time was recorded.

The mirror was part of a moving-coil galvanometer assembly, which used a taut band suspension with a very substantial magnet block bolted to a robust metal chassis. The light source was similar to a car headlamp bulb and ran on 6V AC, provided by a 240/6V AC autotransformer. To satisfy the notion of double insulation, the chassis was supposed to be floating and the whole

recorder was enclosed in a thick plastic case.

Unfortunately the galvanometer elements were not rated to 240V AC and during manufacture an insulated wire was pinched between a metal bracket and the chassis to which it was bolted. The plastic covering the wire had split and the magnet block was alive.

My colleague thought he was working with a few millivolts of transducer output and was in a wet earth situation when the 240V AC jumped across the galvanometer and zapped him.

Modification of the recorder was out of the question, except for locating and repairing the pinched wire and replacing the galvanometer element. A highly uncomplimentary message was painted on both sides of the plastic case, requiring that the recorder only ever be serviced with a 240/240V AC isolation transformer.

Providing a suitable transformer did not entirely eliminate the danger, but it made the risk more tolerable.

And still on safety, I was rather intrigued to discover in one of the workshops a device of German manufacture which was an early version of what is now a compulsory safety switch fitted to all new domestic installations. I arranged for these Earth Leakage Core Balance (ELCB) devices to be fitted to distribution boards around the laboratory as well as providing extension leads which incorporated them.

I avoided fitting a master ELCB to the main switchboard, because a complete shutdown would have been a great nuisance as well as posing a hazard of another kind.

I was trained to maintain radio communication equipment in the days before transistors had been invented. Our instructor showed us how to use a screwdriver as both a voltmeter and a coulomb meter, and a finger as a signal injector.

The finger worked well on grid caps, giving a wow-wow-wow sequence to indicate how much of the amplifier chain was alive and well. Sometimes this was varied when an inexperienced serviceman met a high power PA system. 'Wow, wow, YEEEE-OW!' indicated a pair of 807's in the output stage, with 400V DC on the anode caps...

The screwdriver drew sparks and the result could be interpreted in terms of volts. Or a really fat spark could be some assurance that electrolytic capacitors had not dried out.

When transistors first came onto the market, there was a saying that the transistor was the fastest acting fuse known to man. Screwdriver mechanics were banished.

Now coming back to the present time, the colour monitor of my computer died recently and the manner of its demise suggested a heart attack. The monitor was ten years old and I was advised that buying a new monitor was a better proposition than seeking to have the dead one repaired. (Where have I heard that one before? Ed.)

So having nothing to lose, this old screwdriver mechanic got out a 20,000 ohm per volt multimeter and started probing around. The 240V AC bridge rectifier was working well, but there was no signal on the high frequency inverter transformer.

There was no indication of foul play around the main inverter transistor, but probing around the switch mode power supply controller IC led to a suspicion that one pin lacked bias. Lifting the resistors revealed that an 820k ohm resistor was open circuit.

The 150k ohm bleed resistor across the main electrolytic capacitor following the 240V AC bridge rectifier was also open. Replacing these cost 30 cents and now the monitor is as good as new.

Living in retirement, I place little value on my time but at commercial rates the cost of dismantling the monitor and reassembling it would have supported the original assessment that the repair was not economical.

(Sorry Mr Halliday, but I don't agree. The fault you describe is a very common one in any gear using a switchmode power supply. I have numerous colleagues who make good livings from fitting 30 cent resistors into TVs, VCRs, computers and their monitors — Serviceman.)

Lightning strikes put our local substation out for three hours recently while the rain nearly washed us away. I was glad I had fitted surge diverters to several power outlets around the home.

The computer was not damaged, but a very unfunny signal was placed on the floppy disk used to back-up my word processor. After the storm I re-instated the text, but the last paragraph was repeated over and over again to fill the whole eight megabytes of RAM!

While tediously erasing the unwanted text I reflected on my foolishness in not disconnecting all the equipment when the storm started. I have in my junk box the burnt-up remains of a portable radio/record player which once belonged to my niece. The lass was working as a teacher in the aboriginal school at Gulgong when a lightning surge hit the flat she was renting.

Please carry on the good work. I look forward to reading your columns each month.

Thanks for the kind words about the column, Mr Halliday. We strive to keep it lively and interesting and it's positive feedback like yours that make the effort worthwhile.

If you had not already guessed, I am of the same vintage as you and I clearly recall those 'calibrated screwdrivers'. In some high-powered gear you could measure the voltage quite accurately by the size of the chunk bitten out of the screwdriver. One advantage of the old blade drivers was that you could always reshape them on the grinding wheel. You can't do that with Philips drivers, or any of the other modern 'odd-bod' drivers!

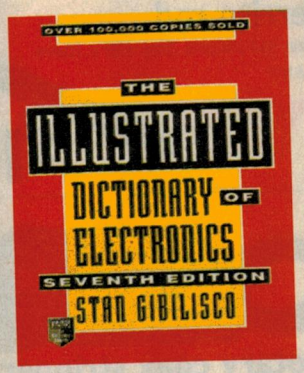
I also remember those PA systems with 807s in the output stage. I was always wary of those black plastic top caps. They had the habit of going brittle and have been known to fall apart, leaving a bare metal topcap to trap the unwary serviceman. That's the one good thing about solid state — dangerously high voltages are not nearly so common nowadays.

Thanks for your stories, Mr Halliday. I'm sure that our readers will have enjoyed your reminiscences as much as I have.

That's all for this month. I'll be back next month with more interesting stories from the service bench. ❖

New Books

Handy reference on terminology



THE ILLUSTRATED DICTIONARY OF ELECTRONICS, Seventh Edition, edited by Stan Gibilisco. Published by McGraw-Hill (Tab imprint), 1997. Soft covers, 234 x 188mm, 788 pages. ISBN 0-07-024186-4. RRP $69.95.

Electronics certainly has an enormous and ever-growing terminology — not surprisingly, for an industry and technology that's about as high-tech and as rapidly changing as any. I guess most of us who've been in the game for a while have long since given up the idea of even trying to keep our heads around it all. So whether you're a newcomer or an old timer alike, the odds are that you'll find a book like this of great value as a reference.

As the title implies, it's essentially a dictionary devoted to electronics and related terminology. In fact it's the seventh edition of this very popular electronics dictionary, and it's illustrated in the sense that there's an explanatory diagram or two on just about every spread of its main 757-page section. That means that only a small percentage of its items actually have illustrations, of course; all the same, it's a lot better than having no illustrations at all.

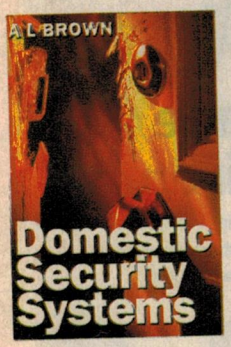
You won't find definitions of every single term in every specialised field of today's electronics, either. That would of course be impossible, as new terms are coming into existence and usage all the time. All you can hope for in a book of this type is that it's reasonably comprehensive and up to date — and in this case it is, on both counts. It's also quite well written, with the terms generally explained quite clearly.

At the back there are three useful data appendices, too. One gives common schematic symbols (although quite a few of these could have been reproduced larger and more clearly), another units and conversions (including MKS-cgs), and the third a listing of common electronics abbreviations (21 pages).

On the whole, then, it should be a handy and useful reference for anyone working in electronics — and especially beginners and students.

The review copy came from McGraw-Hill Australia, of PO Box 239, Roseville 2069. (J.R.)

Home security systems in detail



DOMESTIC SECURITY SYSTEMS, by A.L. Brown. Published by Butterworth Heinemann, 1997. Soft cover, 135 x 210mm, 160 pages. ISBN 0-7506-3235-6. RRP $34.95.

Home security has been one of the growth industries of the past 10 years, and security items such as PIR detectors, CCD cameras, reed switches and so on are now readily available. This book is about designing and installing your own security system, and uses two examples: a semi-detached cottage and a typical three-bedroom detached house. The author is described as an alarm installer and the designs in the book are said to have 'been rigorously put to use on some of the most crime-ridden streets in the world'.

The book assumes the reader has a basic understanding of electrical and electronics principles, which is often more than a lot of security installers have. It presents the material over 10 chapters, and starts with input sensors such as magnetic switches, ultrasonic, microwave and PIR movement detectors, and so on. It gives some background theory on these devices, and brief details of their use and installation. Following chapters cover control systems, output signalling devices, installation techniques, security lighting, video security and door entry systems, along with testing and maintenance, and miscellaneous security gadgets.

In general, it gives a good coverage of the topics, despite its comparatively small size. The writing style is appropriate, and technical without being complex. Unfortunately, the drawings (of which there are many) are often hard to understand, due to a poor choice of font, and over reduction in size. The appendix gives a parts list for each of the designs in the book, which include a simple intercom and siren circuits; all the way to a full security system.

The review copy came from Butterworth Heinemann Australia, PO Box 146, Port Melbourne 3207. (P.P.) ❖

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High intensity WHITE LEDs

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1100mcd
Z 4003
NEW

White light 5mm $9.95
4000mcd
Z 4004
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Plain rod antenna. Size: 100 x 10mm.
R 5107
NEW
$1.50

Pearl catch

Handy tool for picking up small nuts, washers or components from hard to reach places. Uses 4 springy splines to hold items.
T 5117
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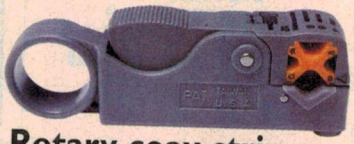

Rotary coax stripper

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T 3640
NEW
$24.95

5-pattern laser pointer

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T 2901
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Keychain mini laser pointer

Clip this pointer to a belt or keep it in your pocket! 1mW laser pointer in tough metal housing, only 6cm long. Up to 50m indoor range. Includes batteries.
T 2903
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2-way panel mount RCA sockets

Nickel plated with red and white inserts.
P 1443

$1.25
NEW

2-way panel mount RCA sockets

Gold plated with red and white inserts.
P 1450

$1.80
NEW

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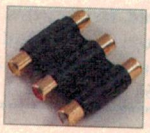
Gold plated with red and white inserts.
P 1453

$2.95
NEW

3-way RCA-RCA socket adaptor

For audio/video applications, gold plated for superior electrical conductance and durability
P 6568



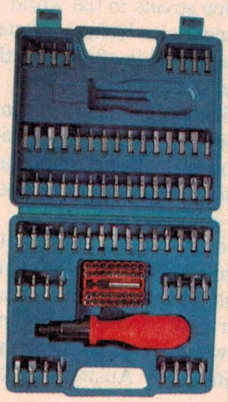
$5.95
NEW

5-piece reversible ratchet wrench set

Handy offset box-end wrenches providing reversible end travel through a simple lever adjustment. Sizes include: 5.5, 6, 7, 8, 10, 11, 12, 13, 14, and 17mm.
T 4560
NEW
$26.95

101-piece bit set

Includes a hard plastic carry case, driver handle and magnetised bit holder. Features flat blade, Phillips, square, securityTorx, Tri-wing, spanner, torque bits and more.
T 4513
$34.80



2-in-1 butane soldering iron

With adjustable flame and soldering iron tips, and large gas reservoir. Maximum blowtorch temperature of 1300°C and soldering temperature of 400°C.
T 1396

NEW
$36.90

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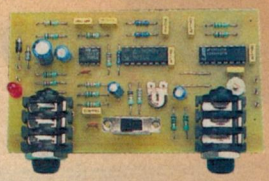
Wah-Wah guitar kit

- Popular guitar effect is controlled by a foot pedal *(not included)*
- Resulting sound produces suddenly increasing/decreasing volume
- Includes PCB stakes, PCB, components and PCB mounted 6.75mm sockets.

K 5620

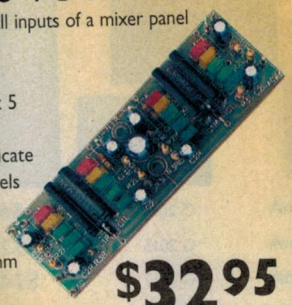


$29.95 SILICON CHIP Sep '98

Dual stereo VU meter

- View or pre-adjust all inputs of a mixer panel with this model
- Contains 2 stereo VU meters with 2 x 5 LED indicators
- Can be used to indicate amplifier output levels
- Supply voltage: 14-18V DC/62mA
- PCB size: 28 x 98mm

K 1302



$32.95

velleman-kit HIGH-Q

Motorcycle intercom

- 2-way communication
- Full duplex operation
- Single volume control for both channels
- Uses 4 x AA batteries or power directly from motorcycle
- Includes all components hardware, PCB, deluxe case and pre-punched screened front panel

K 6021

Accessories not included

$39.95

EA Jul '98

Soundcard pre-amp

- Convert your soundcard into an oscilloscope or waveform generator
- Take full advantage of your soundcard's input capabilities for making measurements
- Includes software to get you started!
- With all components, hardware, PCB, case, pre-punched and screened front panel

K 7347

INCLUDES SOFTWARE

$34.95

EA Aug '98

Shorted turns tester

- Tester for line-output or 'flyback' transformers and HF wound components
- Aids in the servicing of TV receivers, video monitors and computer power supplies
- Identifies horizontal output stage faults
- Includes all components, PCB, case, pre-punched and screened front panel

K 7205

EA Aug '98

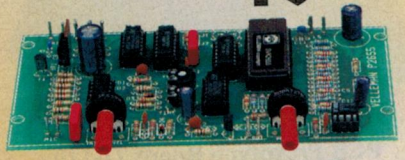
$44.95

Electronic watchdog

- This circuit produces a natural sounding 'bark'
- Features a sensitive 'ear' to everything that comes near it
- Choice of two different 'dogs'
- Power supply: 2 x 8V AC or 9-12V DC/500mA
- Speaker output: 2W at 4ohms

K 1306

$49.80



velleman-kit HIGH-Q

Signal-triggered mains switch

- Turns on your entire home entertainment setup/hi-fi system with just one switch!
- Activate any piece of gear that needs to be on when audio signals are present.
- Comes with all components, hardware, PCB, case, pre-punched and screened front panel

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EA Oct '98

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GREAT VALUE!

Nothing compares to this!

TV stereo decoder

- Provides quality stereo sound
- Connects to your existing Hi-Fi system
- Provides 6 preset tuning channels (VHF or UHF)
- Offers 'surround sound' and sub-woofer channel outputs
- Comes with all components, hardware, PCB, case, pre-punched and screened front panel

K 5990

EA Jan '95

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Availability: Our kits consist of many different parts from numerous suppliers. Whilst we have consulted closely with them and are satisfied as to their ability to supply, sometimes problems can arise in obtaining all of the parts. This means there is a slight chance that availability may be delayed. Rainchecks are available, however if you'd like to check beforehand, please don't hesitate to contact your local store.

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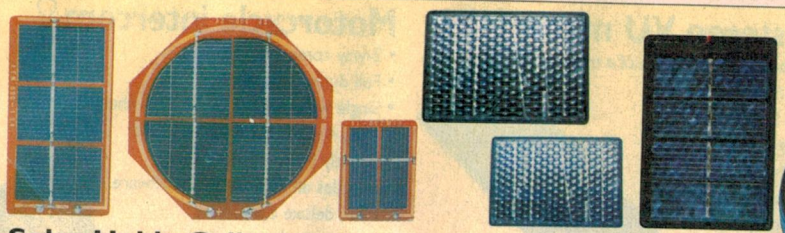


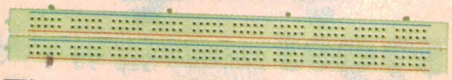
Solar HobbyCell	1.0V 250mA	O 2013	**$6.95**
Solar HobbyCell	1.5V 500mA	O 2015	**$12.95**
Solar HobbyCell	2.0V 500mA	O 2017	**$14.95**
Solar Module	0.45V 400mA	O 2000	**$4.50**
Solar Module	0.45V 1A	O 2001	**$7.50**
Solar Module	2.0V 200mA	O 2011	**$9.95**

Adjustable visor magnifier

Great for working with small components and circuit boards. Lightweight visor that slips onto your head and is flipped down when a magnified view is needed. Selectable 2.2X and 3.3X magnification.

T 4593

$29.95



Tiny Add-on breadboard

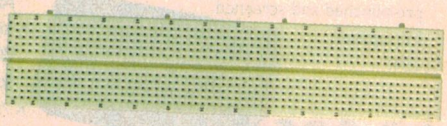
High-class material allows insertion hole to withstand wear and tear without easily deforming. Ideal for high frequency and low static.

Size: 166 x 9.5 x 11mm (LWH).

H 4033

NEW

$6.95



Medium Add-on breadboard

Made from high-class material with V-shaped cross sectional groove allowing DIP IC pins to be inserted across two parts increasing its rate of utilisation.

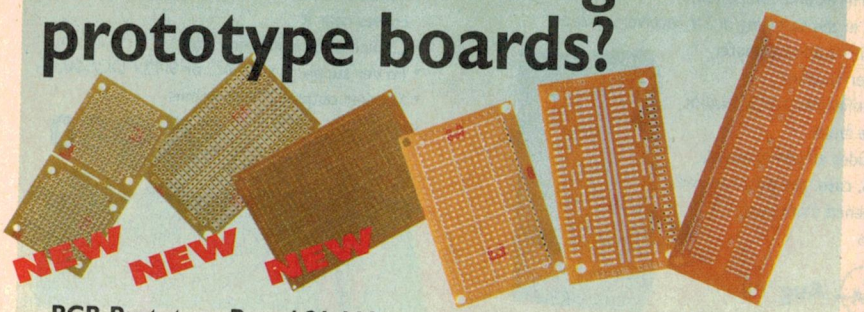
Size: 166 x 35.5 x 11mm (LWH).

H 4034

NEW

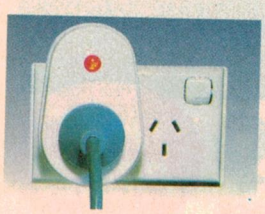
$12.95

And the best range of prototype boards?



NEW **NEW** **NEW**

PCB Prototype Board 21-110	Size: 44mm(W) x 75mm(L)	H 5604	**$2.75**
PCB Prototype Board 21-115	Size: 47mm(W) x 72mm(L)	H 5603	**$2.75**
PCB Prototype Board 21-113	Size: 47mm(W) x 72mm(L)	H 5608	**$2.75**
Prototype Board 21-109	Size: 46mm(W) x 93mm(L)	H 5607	**$3.10**
PCB 8 to 20 Pin IC Dual Socket	Size: 44mm(W) x 91mm(L)	H 5601	**$3.25**
PCB Prototype Board 21-111	Size: 49mm(W) x 131mm(L)	H 5605	**$3.25**
PCB Prototype Board 21-116	Size: 115mm(W) x 160mm(L)	H 5609	**$6.95**



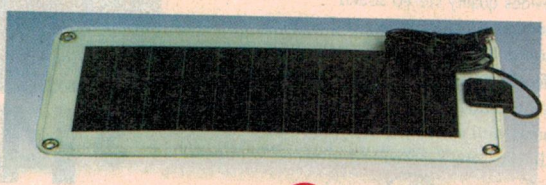
DSE Surge protector

3 M.O.V.s and 4500V surge capacity.

M 7171

$22.95

NEW



Canon

Canon unisolar flexible panel 5W

Ideal trickle-charger for battery maintenance during storage. Maintains a full charge on a standard 12V battery. Great for boat and 4WD owners. Size: 554 x 247mm.

O 3211

$135

SCOOP PURCHASE

NEW

Aluminium box *with plastic end caps*

Size: 54 x 224 x 36 mm (WLH).

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H 3009

$1.95

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9-range analogue multimeter

Small and lightweight with built-in diode, decibel and battery test. Includes protected fuse, mirrored scale and 150mA DC current.

Q 1005

$19.95

Due mid-October

NEW

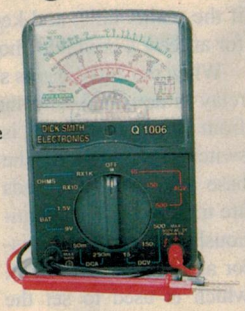
12-range analogue multimeter

Features safety recessed test lead connections, decibel and battery test. With built-in diode, fuse protected and mirrored scale. DC current is 50mA and 250mA.

Q 1006

$25.50

Due mid-October



NEW

Digital map measuring meter

With magnifier and calculator, determines the actual distance between two points on a map or plan by multiplying the distance in millimetres by the scale of the map or plan.

NEW

Q 1399

$39.95

Digital engine analyser

Monitors RPM, dwell angle, points and battery charging system. Includes inductive pick up, alligator clip assembly and carry case.

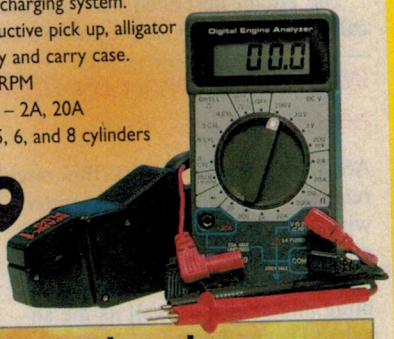
Tach – x 10RPM

DC current – 2A, 20A

Dwell – 4, 5, 6, and 8 cylinders

Q 1556

$99



30-range digital multimeter with temperature

3.5 digit meter with 2000 count LCD and -40°C to 1000°C temperature range. Comes with temp. probe (-40°C to 260°C) Features capacitor, transistor, resistance and diode tests.

Q 1447

$79.90

NEW

26-range analogue multimeter

Features DC and AC volts ranging from 0 to 1000V, DC current from 0 to 10A (separate jack). Resistance from 0 to 50MΩ. Temperature from -50°C to 260°C (using optional probe) and includes built-in stand and handle.

Q 1007

$84.95

NEW

Due mid-October

Air speed and temperature meter

Handheld meter with 4 digit display for wind speed and temperature readings, with protective carry case. Air flow range: 0.4-30m/s, 80-4900f/min. Temp range -10° to 50°C, +14°to 122°F. Continuous moving average. Min/max/avg (single point). Air flow average for multipoints.

Q 1411

$199

NEW

Digital callipers

High precision tool for engineers, designers, students and serious hobbyists measuring from 0.01mm to 150mm. With metric/imperial conversion and auto off function.

Q 1412

$139

Clamp meter

3.5 digit 1999 counts with high resolution, ACA current measurement up to 700 amps, PEAK reading and DATA HOLD function.

Q 1475

$169

This magazine is now on sale at all of our New Zealand stores!

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NSW	Penrith	PowerHouse, cnr Batt & Mulgoa Rds	4721 1544
NSW	Rockdale	Shp M2 Rockdale Plaza, Princess Hwy	9588 9309
NSW	Nowra	38 Berry Street	4422 5522
VIC	Bourke St	Shop 2, Basement cnr Bourke/Swanston Sts	9639 0396
WA	Rockingham	Cnr Read St/Commodore Dve	9592 2888
WA	Morley	269 Walter Road	9375 8660

DICK SMITH ELECTRONICS

That's where you go!

Circuit & Design Ideas

Interesting original circuit ideas and design tips from readers. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. We therefore cannot accept responsibility, enter into correspondence or provide any further information.

UPS for cordless phones

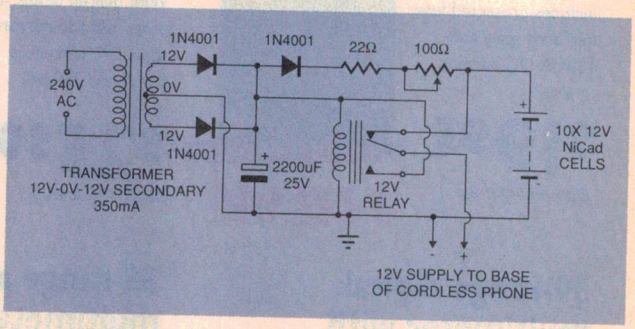
ORDINARY CORDLESS PHONES have a fixed base unit with a mobile handset, and are very convenient. So convenient in fact, that people don't often have a standard phone in the house, and simply carry the handset around from room to room, or even out in the garden. The problem is that the fixed base unit generally runs off a 12V plug pack, and if the mains fails for any reason then the phone is dead. The handset stops functioning and no calls can be made or received until the power is restored...

The circuit described here can automatically supply 12V DC to the phone's base unit if the mains fails, and keep the phone going for at least a couple of hours.

When the 240V mains supply is present, the relay is activated, and the rectified 12V DC from the transformer is switched through to the base unit. The 10 NiCads are trickle charged continuously via the 22Ω resistor and the 100Ω trimpot, which is used to set the charge current.

If the mains supply fails, the relay is de-activated and the batteries are switched through to the output, supplying 12V to the phone's base unit.

Pradeep G.
Alappuzha, India **$35**

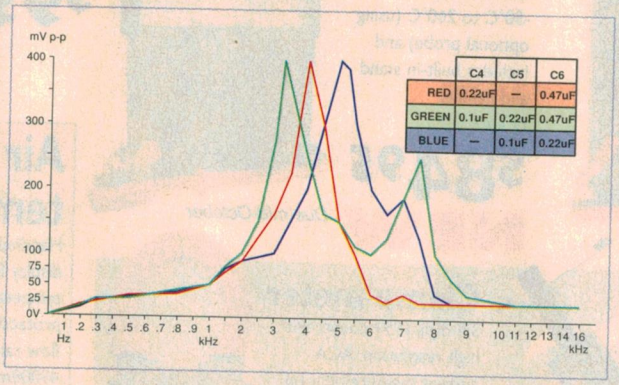


Whistler receiver for Earth's natural radio

AS THE NAME implies, this circuit will receive the 'sounds' generated within and around the Earth, and via the magnetosphere. You'll hear all sorts of whistles, chirps, warbling and clicks, as well as the so-called Dawn Chorus.

The signals are propagated in the *audio band* as random bursts of CW carrier waves, via discharges from lightning etc. The low frequency signals are generated all over the world, and are ducted along the Earth's magnetic fields, where they can be detected with little more than an audio amplifier.

The most common problem with trying to detect these sounds is that the 50/60Hz mains hum (with all of its harmonics) tends to swamp everything, particularly as most designs use long-wire or telescopic aerials or even large loop aerials as the standard way to pickup the wanted signals. Hum reduction is usually done by filtering the signal after the preamp stage, and all reception takes place out of doors, well away from any AC mains distribution systems or other human made LF emissions.



My design is very simple and circumvents active filtering by resolving the hum problem at the aerial input. This has proved so effective that reception can be made within the home, up to 10 feet from a television receiver — quite unheard of until now.

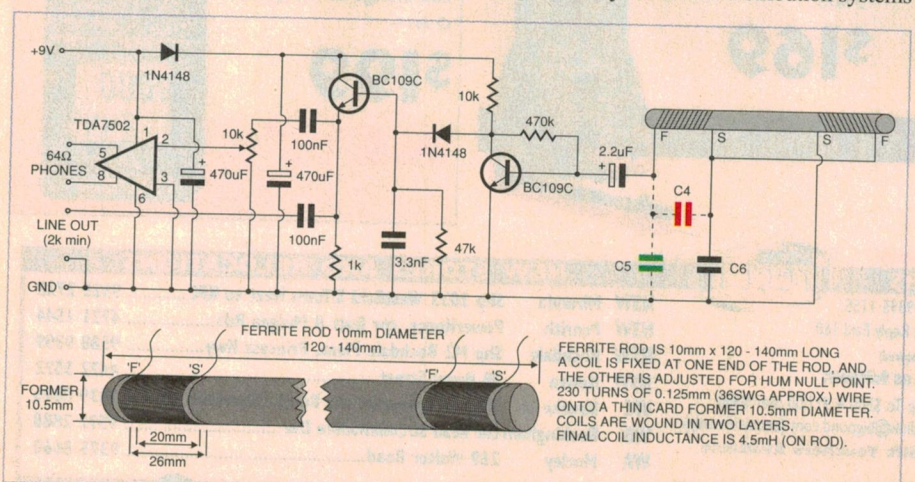
The preamp is high gain and low noise, with a diode detector to roll-off the low frequency beacons between 10-16kHz, reducing the need for a large value snubbing capacitor. Bias is supplied directly to the emitter follower buffer, which is used for recording the signals at a standard microphone level. The use of a TDA7052 is necessary for headphone listening, and by providing a floating output from the IC's internal tied bridge design, we can minimise eddy currents feeding back into the aerial.

The arrangement of placing two coils onto one ferrite rod is to phase out any directional low frequency signal. This is a product of setting one coil to resonate at the low frequency end of the band, with the other coil likewise, but sufficiently moved up in combination of phase and frequency to allow the most active part of the Natural Radio band to be received.

You can see the frequency response plotted with a couple of different capacitor values; the one most usable is the 750Hz to 8kHz response at 40mV.

I would welcome any correspondance on this circuit to the address below.

Brian Lucas
PO Box 694, Saint Helier,
Jersey JE4-9PZ, Channel Islands. **$40**



As an added incentive for readers to contribute interesting ideas to this column, the idea we judge most interesting each month now wins its contributor an exciting prize, in addition to the usual fee. The prize is a complete closed circuit TV system, comprising a 5" B&W video monitor, CCD video camera with stand, power supply and cabling. This system comes from our sponsor Allthings Sales & Services, and is valued at $369.00!

Win our 'IDEA OF THE MONTH' Prize!

Voltage controlled rotating LED display

THIS MONTH'S WINNER!

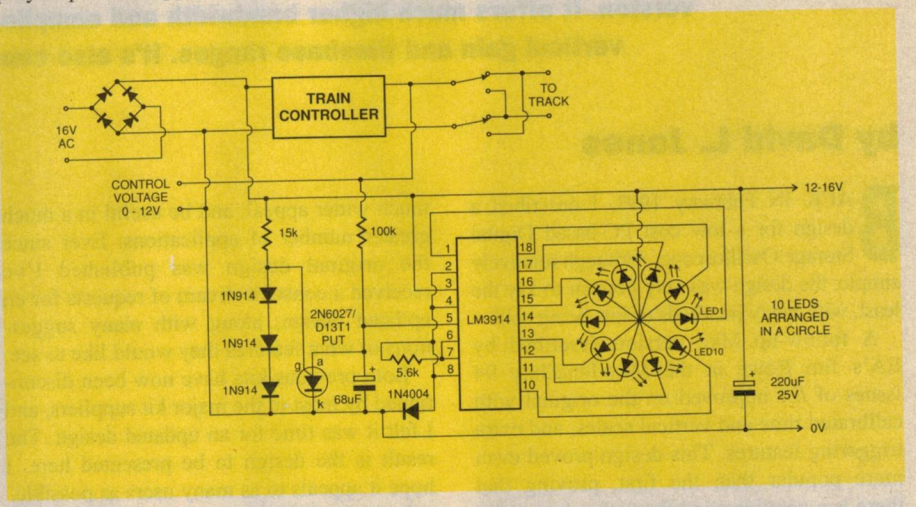
THIS CIRCUIT provides a voltage controlled rotating pattern on 10 LEDs arranged in a circle. Normally to provide a this kind of effect on a ring of LEDs you would expect to use digital ICs, however, for this application the LM3914 provides all the drive and control needed to drive 10 LEDs from one chip. Being an analog circuit it is also substantially immune to electrical noise.

To produce the rotating pattern the control voltage charges the 68uF capacitor through a 100k resistor, and when the set point voltage of 1.2V is reached (the 10th LED is lit), the D13T1 fires — resetting the capacitor and the circuit starts again from LED1. In this way the rate of rotation is controlled by the control voltage, which can vary from 0 to 12V.

The 1N4004 provides a reference offset to LM3914 analog input so that the minimum voltage LED (LED1) will be on. The value of the 5.6k resistor can be varied to control the LED brightness.

The circuit was primarily designed to connect to a transistor model train controller, however it can be used for other displays. With the train controller, the display's power supply is derived from the controller's DC input, and the control voltage from the train controller's output *before* the reversing switch.

Richard Blyton
Kambah, ACT **$40**



Solar Regulator mods

I HAVE MADE some modifications to the Solar Regulator (Nov/Dec 1994) which eliminates one of its annoying habits — that is, very rapid switching when the battery is lightly loaded, or supplied from a high current source. It gives the ammeter that I have wired in the system quite a workout!

The modification is to add a time delay (approx. one minute) from when the charger switches off to when it is allowed to turn on again. I have added a 555 wired as a monostable, triggered by the output of IC2a, pin 14. The 555 switches an NPN transistor which then controls the normal charging sequence.

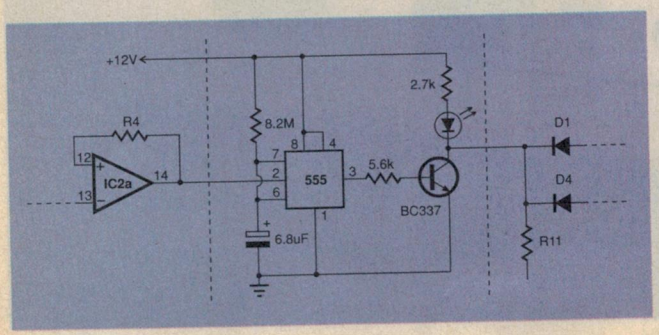
Diodes D1 and D4 along with resistor R11 are separated from pin 14 of IC2a, and connected to the collector of the transistor.

The time delay is constructed on a small piece of Vero or matrix board, with flying leads for the interconnections to the regulator board. Power was picked off from C2, the cathode of D1 was lifted from the board, the link immediately above IC2 was removed, and trigger to the 555 (pin 2) was soldered in the vacant left hand hole. A link from the cathode of D1 was taken to the right hand hole, and then to the collector of the new transistor.

When the battery voltage reaches the charger's preset value, the output of IC2a goes low — which triggers the 555, and its output also goes low. The transistor inverts this signal, which then stops the charging.

When the battery voltage has dropped enough to turn the charger back on, the 555 starts to time out. After the delay, the 555's output swings high, the transistor switches on and the charging cycle is enabled. It should be noted that the actual delay time will be the sum of 555 delay plus the battery voltage decay time.

C. Wylie
Leumeah, NSW **$35** ❖



A PC-Based DSO Adapter Mk3 - 1

Here's the first of two articles from the designer of our very first and very popular Digital Sampling Oscilloscope Adaptor of 1993, describing an all-new and much improved version. It offers much higher bandwidth and sampling rates, plus full software control of vertical gain and timebase ranges. It's also considerably easier to build — and use!

by David L. Jones

BACK IN February 1993, I described a design for a low cost PC-based Digital Storage Oscilloscope. Although relatively simple, the design was very popular to say the least, with many hundreds of kits being sold.

A follow-up Mk2 version described by EA's Jim Rowe in the May/June/July 94 issues of *EA* improved on the original with calibrated time and vertical scales, and extra triggering features. This design proved even more popular than the first, proving that there is a genuine need for such a low audio bandwidth PC based scope.

But it's probably no surprise to find that many people have asked for a higher performance design, one with a bandwidth of several megahertz. Such a device would have a much wider appeal, and be useful in a much greater number of applications. Ever since the original design was published I've received a constant stream of requests for an updated design, along with many suggestions of what features they would like to see.

Both previous kits have now been discontinued by most of the major kit suppliers, and I felt it was time for an updated design. The result is the design to be presented here. I hope it appeals to as many users as possible.

I wasn't able to incorporate *all* of features asked for in this new design, as this simply wasn't possible. Some people wanted a portable battery powered version, others wanted four to eight channels, 100MS/s, 50MHz bandwidth, etc, etc.

By far the most number of requests were for three major improvements: higher sample rate, dual channels, and operation more like an analog CRO. The majority of uses were simply using the DSOA as a normal analog CRO — with the added benefit of single-shot aquisition and waveform storage/printing of course.

Surprisingly, cost and ease of construction did not rate high on most users' wish lists. However, I do consider these points very important, and have considered them carefully when designing this new DSOA.

The design to be presented here differs dramatically from the two existing designs. It has four major new features — dual channels, 20MS/s sample rate (20 times that of

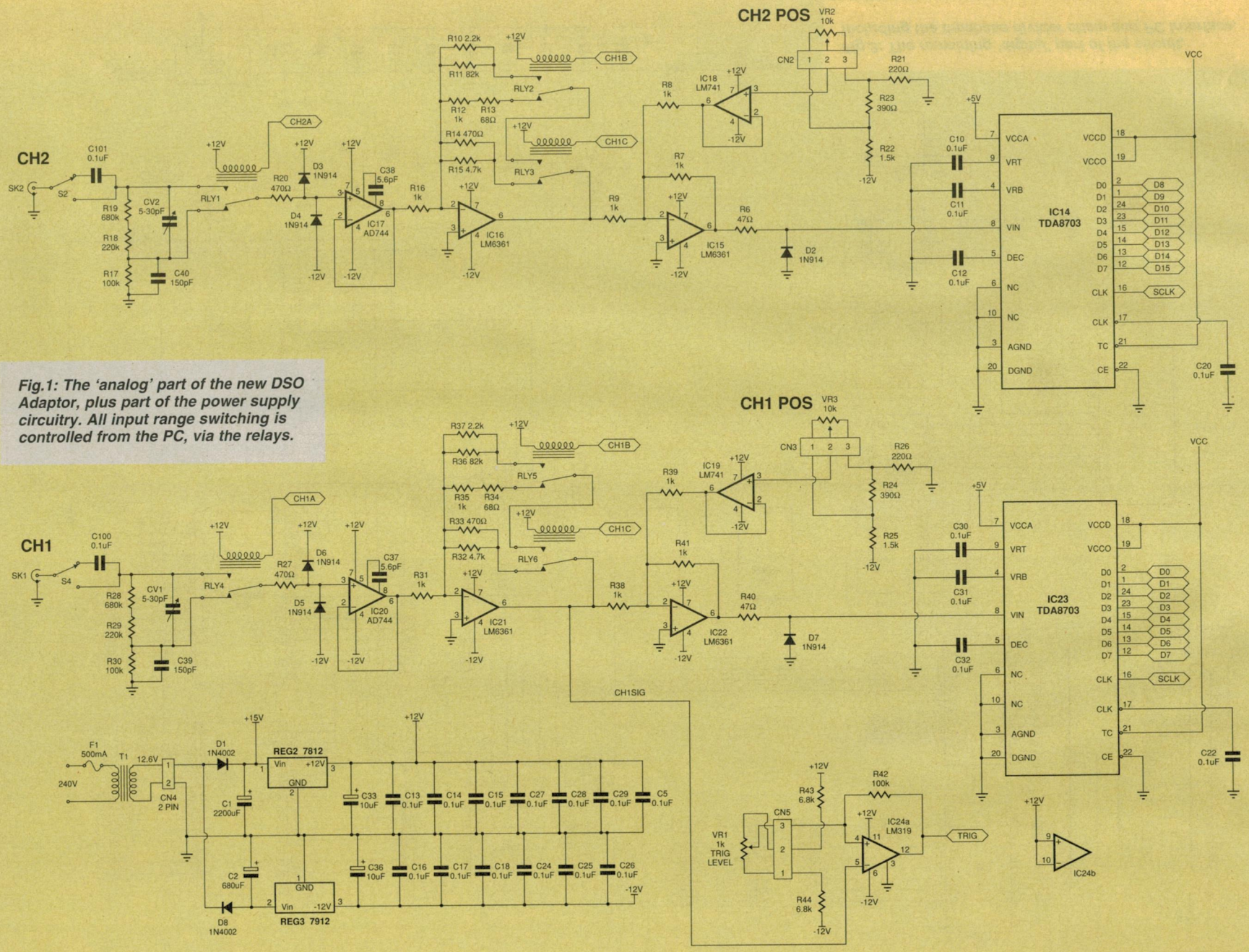


Fig.1: The 'analog' part of the new DSO Adaptor, plus part of the power supply circuitry. All input range switching is controlled from the PC, via the relays.

A PC-Based DSO Adapter Mk3 — 1

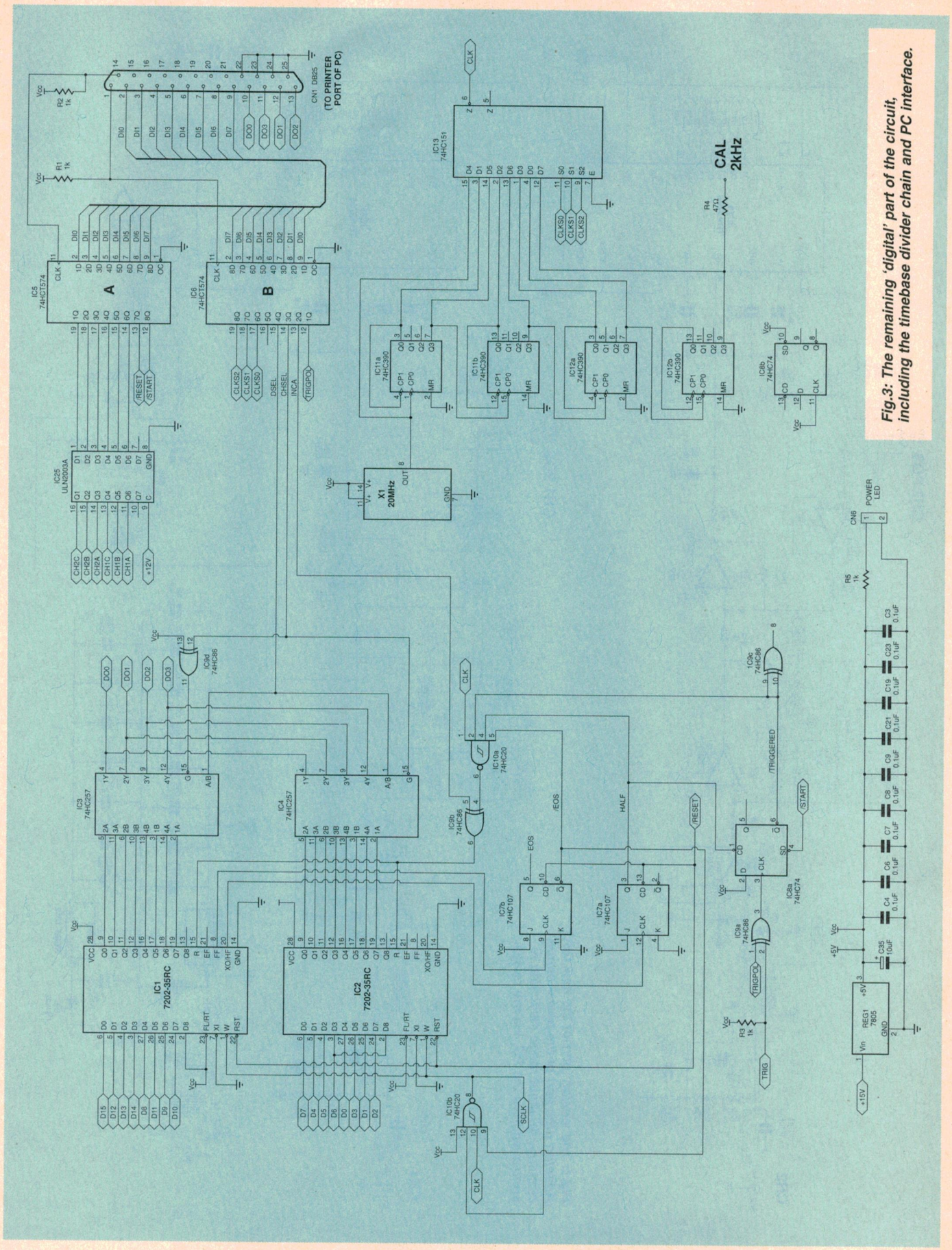


Fig.3: The remaining 'digital' part of the circuit, including the timebase divider chain and PC interface.

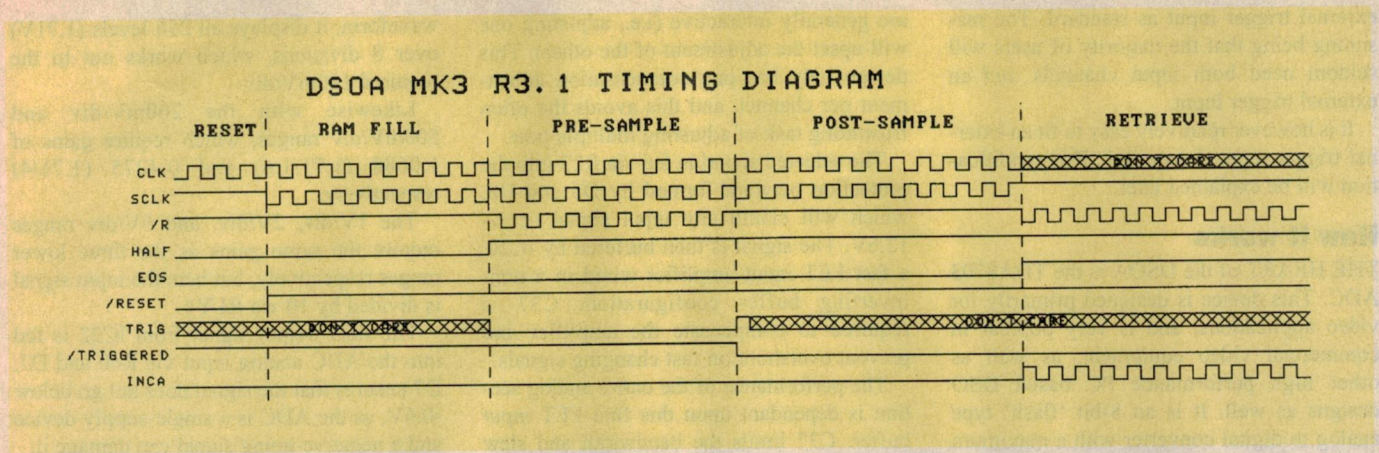


Fig.2: Use this timing diagram, in conjunction with the text, to get a good understanding of the sequence of taking samples, storing them in the FIFO RAMs and retrieving them again.

the Mk2), fully PC controlled timebase and vertical attenuation ranges, and vertical waveform position controls. At the same time, this new design is not that much more expensive than the Mk2 design, and is easier to construct.

The new design still provides 8-bit resolution per channel, as anything more is not warranted in a DSO (and would probably double the price!). Very few commercial DSO's bother going beyond eight bits, and if they do it's usually through software averaging.

There are 18 timebase ranges, available from 100ns/div to 50ms/div in a 1-2-5 sequence, as well as six attenuation ranges from 100mV/div to 5V/div in the same 1-2-5 sequence. Both are fully adjustable by the PC software. The analog bandwidth is at least 5MHz, but can be improved as will be discussed later.

Support for long term data logging has been dropped as standard, although it is possible to use it for data logging given the right software. The reasoning behind this is that 8-bit sampling and dual channels are not sufficient for the majority of data logging applications. Data logging is best left to a dedicated design.

I have been often asked why I didn't do a version of the DSOA that uses a plug-in PC card, either for the entire DSOA, or just for the interface. The main reason, apart from the extra cost and complexity, is that it cannot be used with a laptop computer. At least with the parallel port the DSOA can be used with almost any IBM compatible computer. Nearly half of all of the users of the previous Mk1 and Mk2 have used them with a laptop computer. I even know of one user who has used a battery powered DSOA with a palmtop computer!

People have also asked about taking advantage of the enhanced parallel port (EPP) standard, which allows faster transfer rate. Once again, it comes down to being compatible with the most number of machines. Not every machine has an EPP, but they all have a standard parallel port.

Given all the new features in this design, it was not possible to use the existing DSOA Mk2 interface and architecture, which makes the DSOA Mk3 incompatible with any existing software. There are however two new software programs available: a simple DOS-based program that is available free, and a complete Windows based program with dual timebases, measuring cursors, averaging, history display, Windows printing capability and more. Both of these will be discussed later.

Design considerations

THE FIRST decision to make was that of the analog to digital converter, as this single component would decide the upper performance limit of the design. This was quite an easy task, as the only suitable easy-to-use high speed A-D converter that is readily available in Australia at low cost is the Philips TDA8703. This device can operate at a maximum sample rate of 40MS/s, so I aimed for that sample rate as a maximum.

The next decision was the type of RAMs to use. This appeared simple at first glance: standard cache SRAM's that are used on PC motherboards are very fast (15ns), cheap and readily available. I had even used them previously in my PC-Based Logic Analyser Design. But after a bit of thought, I realised there was a catch.

Unlike the Mk2 version, I wanted the design to have 50% pre- and post-sampling just like most commercial DSO's. This meant having two 15-bit counters — one for the RAM address, and one for the post trigger counter. This requires eight counter chips; quite a large number, and one that would require quite a deal of PCB space.

I was tempted to use Programable Logic Devices (PLD's), but these are quite specialised components that must be pre-programmed. I wanted to avoid this if at all possible.

This is when I had the idea to use FIFO (First In First Out) RAMs. FIFO RAMs are essentially SRAMs with inbuilt address counters, and also have the capability to do 50% post counting as well! This meant I could use one FIFO chip to replace an SRAM *and* eight counter chips, with the bonus that the FIFO's dual data ports would make the PCB layout a lot easier. They are also reasonably priced and readily available...

However, FIFOs have three disadvantages. The first is that you can't use only a part of the RAM; you must use it all (in this application anyway), which means slower update rates. The second is that they are aren't quite as fast as SRAMs, which would limit the maximum sample rate to 20MS/s. The third drawback is that they are only available in relatively small sizes (4-8KB at most).

Compared with the 32KB RAM size of the previous DSOAs, this may seem somewhat limiting. But as I only wanted to design a CRO and not a data logger, it isn't really a disadvantage. I decided that the advantages outweighed the disadvantages (as I will show later), and I have thus chosen FIFOs for this design.

The sample rate and buffer size in this design was therefore limited by the FIFOs. But the good news is that they allowed me to fit the entire design onto one single sided PCB. I originally started off with 4KB FIFOs, but finally settled on 1KB devices as I will explain later.

I have opted to have both the attenuation and timebase settings fully controlled from the PC. Although probably not as cheap (six relays are expensive) or convenient as having controls on the front of the DSOA, it drastically reduces the amount of internal wiring, and makes construction easier. It is also easier to generate controls lines from the PC than it is to read back front panel switch positions into the PC, which would have been necessary had I used manual controls.

I have elected to have the trigger signal fixed on channel 1, and no facility for an

external trigger input as standard. The reasoning being that the majority of users will seldom need both input channels *and* an external trigger input.

It is however relatively easy to fit an external trigger input if required. This modification will be explained later.

How it works

THE HEART of the DSOA is the TDA8703 ADC. This device is designed primarily for video applications, and is very popular in commercial video equipment, as well as other high performance PC based DSO designs as well. It is an 8-bit 'flash' type analog to digital converter with a maximum sample rate of 40MHz. The -3dB bandwidth of its input buffer is the Nyquist limit of 20MHz. It has selectable binary or two's-complement three state outputs. The tri-state output was not needed in this design due to the dedicated input port on the FIFO RAMs. The DSOA uses the binary output mode by tying the TC input HIGH.

The TDA8703 requires only a single +5V supply, but it does have separate analog and digital supply pins. It also has its own internal reference voltages of 3.26V and 1.55V, and thus requires a full scale input signal of 1.71V (3.26 - 1.55) biased by 2.4V. This requires the input signal to be scaled and biased accordingly.

There are two input channels with identical analog circuitry, so we will only discuss channel one here. The input from the probe comes in via a BNC connector on the front panel. It either passes through C100 or is fed straight through depending on the setting of the AC/DC coupling switch S4. With S4 in the AC position, any DC voltage present in the input signal is removed. The signal is then applied to the input voltage divider formed by R28, R29 and R30, which divides the signal by 10 (when required). The total resistance of the voltage divider is 1MΩ, which allows the use of standard x10 CRO probes.

The divided by 10 signal is fed along with the original input signal into range selection relay RLY4. This relay, which is under software control, selects which amplitude signal will be fed through to the following buffer stage.

With R28, R29, and R30 being such high values, any stray capacitance will effect the division ratio when measuring any reasonably high frequency. Even 1pF of stray capacitance has an impedance of 160k at 1MHz. This can significantly effect the divider, and will show up on square waves as overshoot or undershoot. To compensate for this, CV1 and C39 are used to keep the division ratio constant at high frequencies.

The analog section was deliberately designed to avoid the use of multiple compensation adjustments per channel, which are generally interactive (i.e., adjusting one will upset the adjustment of the other). This design only has one compensation adjustment per channel, and this avoids the often frustrating task of adjusting multiple pots.

The selected signal is fed via R27 into the protection network formed by D5 and D6, which will clamp any input signal to +/- 12.6V. The signal is then buffered by IC20, a fast FET input amplifier wired in a non-inverting buffer configuration. C37 is required to compensate the amplifier and prevent overshoot on fast changing signals.

The performance of the entire analog section is dependant upon this first FET input buffer. C37 limits the bandwidth and slew rate of the amplifier. With C37 equal to 5.6pF, the -3dB bandwidth is approximately 7MHz and the slew rate about 35V/us. This is adequate for a 20MS/s DSO, but higher performance may be achievable by lowering the value of C37.

The buffered signal is then fed into the range compensation amplifier formed by R31 to R37, IC21, and relays RLY5 and RLY6. This amplifier is wired in an inverting configuration, and provides three different gains selectable under software control by the two relays. The three ranges effectively provide the 1-2-5 voltage range sequence like a normal CRO.

The signal is then fed into a summing amplifier formed by IC22, R38, R39 and R41. This summing amplifier adds the amplified input signal to the offset voltage produced by the CH1 vertical position control VR3. This allows the waveform to be effectively 'moved up and down' within the ADC's input range. The voltage references for the CH1 vertical position control are derived from the voltage divider formed by R24, R25 and R26. Reference voltages of approximately -1.25V and -3.5V are present across the CH1 position pot VR3. This allows the waveform to be moved a little bit outside of the ADC reference range if need be. A negative offset voltage is required due to the inversion of IC22.

Let's now take the example of the 100mV/div range and see how the gain and summing stages work to give us a calibrated vertical scale.

The PC displays eight vertical divisions on the screen just like a regular CRO, so if we are on the 100mV/div range, then this gives us a full scale input voltage requirement of 800mV. As stated before, the ADC requires a full scale signal of 1.71V, therefore we have to amplify the input signal by 2.1375 (1.71/0.8) to give us the required ADC input level. Relays RLY5 and RLY6 are set to put R36 and R37 into the feedback path of IC21. Along with R31, this gives a gain of 2.1425, close enough to the required 2.1375. When the PC reads and displays the waveform, it displays all 256 levels (1.71V) over 8 divisions, which works out to the required 100mV/div.

Likewise with the 200mV/div and 500mV/div ranges, which require gains of 1.0688 (1.71/1.6) and 0.4275 (1.71/4) respectively.

The 1V/div, 2V/div, and 5V/div ranges require the same gains as the three lower ranges respectively, but here the input signal is divided by 10 via RLY4.

The final output signal from IC22 is fed into the ADC analog input via R40 and D7. D7 ensures that the signal does not go below -0.6V, as the ADC is a single-supply device and a negative-going signal can damage it.

C30, C31 and C32 decouple the internal reference ladder of the ADC. C22 is used to decouple the alternative clock input.

Triggering

THE GAIN compensated CH1 input signal is picked off at the output of IC21 and fed directly into the inverting input of the trigger comparator IC24a. The trigger level control VR1 is tied to a reference voltage of approximately 1.6V above ground, which allows triggering over most of the ADC input range. R42 provides a small amount of hysteresis to help prevent false triggering.

All of the relays are driven from IC25 (ULN2003A), a seven-way Darlington driver with TTL compatible inputs. Individual transistors for each relay would probably have been cheaper, but they take up considerably more board space.

CH2 is identical to the operation of CH1, except that the trigger signal is not available from CH2.

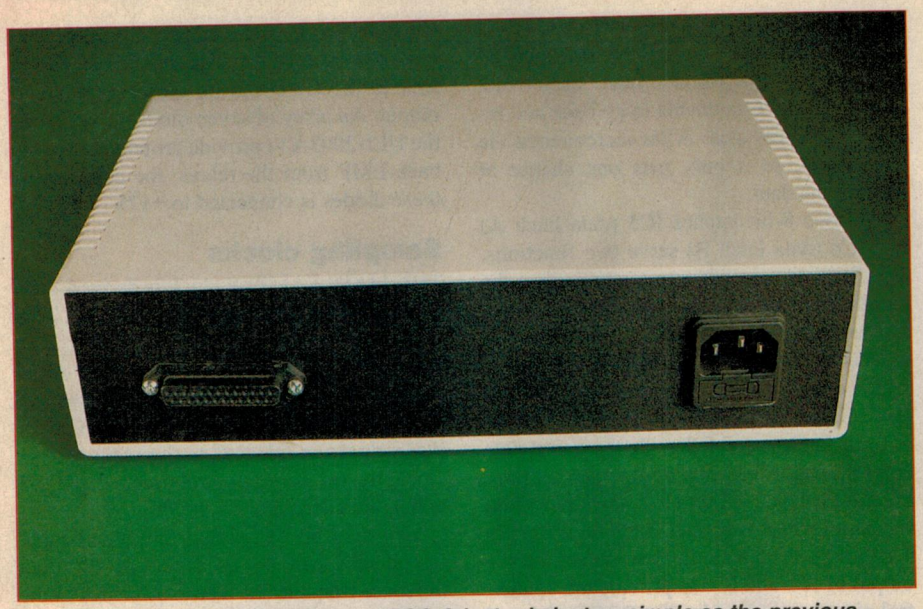
That's all there is to the analog section. Let's now take a close look at the operation of the digital section.

Inside the FIFO

THE ENTIRE operational sequence of the DSOA is centered around the FIFO RAMs, so it is important that we discuss this first.

The 7200 family of FIFO RAMs comprise a 9-bit wide SRAM memory core (1KB in the case of the 7202), a 9-bit input port, a 9-bit output port, two address counters and associated control logic. One address counter is used for the WRITE location, and the other for the READ location. The current address location is referred to as a 'pointer', hence there are both READ and WRITE pointers.

There are three 'flag' outputs that show the current status of the address pointers: the EMPTY, HALF, and FULL flags. All three are active-low outputs. The EMPTY flag is true (low) when both the READ and WRITE pointers are equal — i.e., the RAM is empty. The HALF flag is true when the WRITE pointer is 512 address locations ahead of the READ pointer, i.e, when the RAM is half



As you can see, the rear of the new DSO Adaptor is just as simple as the previous models: an IEC mains input connector and a DB-25 connector for the link to your PC.

full. And the FULL flag is true when the WRITE pointer tries to go more than 1024 locations ahead of the READ pointer; i.e., the RAM is full.

The control logic will stop the READ pointer incrementing when the RAM is EMPTY, and also stop the WRITE pointer incrementing when the RAM is FULL. Both pointers can be incremented independently of one another (until FULL or EMPTY), which means that data can be written into and read from different addresses at the same time, via the dedicated input and output data ports.

The active-low RESET input resets the FIFO to the EMPTY state. There are also other inputs and outputs that are mainly concerned with expanding the depth and width of the FIFO, but these are not used in this design and will not be discussed.

As there is no external address bus on the FIFO, the actual address of the internal RAM is not important. All that is important is knowing wether the RAM is empty or full. This makes FIFOs ideally suited to the kind of sequential data buffering application required in the DSOA. The HALF full flag also allows us to easily have 50% pre- and post-sampling, as I'll explain later. In fact, had the FIFO *not* had the half full flag (some types don't), I would have opted for the cache SRAMs.

The other members of the 7200 FIFO family range from 256 bytes to 16KB. All are fully pin compatible and can be simply dropped into circuit to provide whatever buffer size is required.

The 7200 family is manufactured by Advanced Micro Devices (AMD), but pin compatible devices are available from other manufacturers. The 35ns version will support clock rates up to 22MHz, which is just sufficient for our application at 20MS/s. The AMD 7202-35RC device is readily available from RS Components.

Digital operation

LET'S START with the main operational sequence of the digital hardware, which is best described with the aid of the accompanying timing diagram. (Fig.2)

The operation is split into five steps: Reset, RAM Fill, Pre-Sample, Post-Sample and Retrieve.

You will notice from Fig.3 that the Read, Write, and Reset lines of both FIFOs (one for each channel) are connected together. This means that both FIFOs operate indentically in the following procedure, and thus the flag outputs are only required from one of the FIFOs (IC1 made the PCB layout easier).

The Reset state can be initiated at any time from the PC by simply setting the /RESET line LOW. This resets the two flip-flops IC7a and IC7b, and both of the FIFO RAMs. The reset causes the HALF line to go LOW resetting IC8a, which in turn disables the FIFO read clock via IC10a. While the reset line is low, the main sample clock (SCLK) is disabled — which stops all sampling of the ADC.

When the /RESET line is returned HIGH, the circuit enters the RAM FILL mode (Fig.2). In this mode, SCLK is enabled which allows sampling of the ADC to occur, and subsequent storage in the FIFO RAM. The TDA8703 ADC samples the incomming signal on the positive edge of SCLK, and the converted data is latched onto the data output pins before SLCK returns LOW. This data is then stored into the FIFO on the negative edge of SLCK. The next positive edge of SCLK increments the FIFO WRITE pointer to its next address.

During the RAM FILL period, the trigger signal is disabled because the HALF line has not yet gone active to enable the trigger latch (IC8a). While the HALF signal is LOW, it keeps the trigger latch in its reset state.

The RAM FILL period is required in order to allow the RAM to be at least half filled with data. This is to ensure that the data the PC reads back will always contain half pre-trigger information and half post-trigger information. If a trigger was to occur before the RAM is half filled, then we would have an indeterminable number of pre-trigger samples (if any at all).

When the FIFO reaches its 512th address, the internal logic sets the /HF (Half Full) pin LOW, which triggers IC7a. This latches the HALF line HIGH. At this point the DSOA enters the PRE-SAMPLE mode. When the HALF line goes high, it enables the trigger latch (IC8A), and also enables the four-input NAND gate (IC10a). When IC10a is enabled, this allows the CLK line through to the FIFO's READ pointer input. The READ pointer clock then follows (512 locations behind) the WRITE pointer. The PRE-SAMPLE mode will continue indefinitely until a trigger signal occurs, and the READ pointer will continue to follow 512 locations behind the WRITE pointer, never allowing the RAM to fill.

Once in PRE-SAMPLE mode with the trigger latch enabled, the DSOA is ready to be triggered at any time. The TRIGPOL line controlled from the PC can be used by the software to invert the trigger signal coming from the trigger comparator by using controlled inverter IC9a. The trigger latch can be either triggered from the input signal via IC9a, or from the software which can set the START line low.

Either event will trigger the trigger comparator and set the /TRIGGERED line LOW. This will put the DSOA into POST_TRIGGER sampling mode by disabling the READ pointer clock using IC10a. Any further trigger events from this point on will have no effect. The DSOA will continue to sample the input and store into the RAM, but with the READ pointer stationary, the WRITE pointer will continue incrementing from address 512 until the RAM is full.

When the WRITE pointer tries to increment beyond the 1024th address, the internal logic sets the FF (Full Flag) pin LOW. This triggers IC7b and sets the EOS (End Of Sampling) line HIGH. This EOS line signals to the PC (via pin 15 on the parallel port) that the DSOA has finished sampling. The /EOS line (from the Q-bar output of IC7b) disables SCLK via IC10b. The DSOA is now in RETRIEVE mode. Some of you will notice that the /EOS line also disables IC10a, but this was already disabled by the /TRIGGERED line anyway. So it functionally doesn't do anything, but it did make the PCB

layout easier...

When the DSOA is in RETRIEVE mode, the WRITE pointer is 1024 locations ahead of the READ pointer, and thus it's a simple matter of allowing the PC to increment the READ pointer and retrieve the data.

Fetching the data

DATA RETRIEVAL is accomplished using the INCA, CHSEL, and DSEL lines in combination with IC3 and IC4 (quad tri-state two input multiplexers, or 'mux'). IC3 and IC4 multiplex all 16 data outputs from the FIFOs onto the four parallel port input pins DO0-DO3 (CN1, Fig.3).

The PC starts by setting the CHSEL line low, which enables IC4 and allows data to be read from CH1. IC3 is disabled by IC9d, which inverts the CHSEL line. This ensures that IC3 and IC4 don't output data at the same time. The PC then sets the DSEL line HIGH, which switches bits 0, 1, 6 and 7 through the mux and onto the parallel port. DSEL is then set LOW, which switches bits 2, 3, 4 and 5 through the mux and onto the parallel port. The PC now has all eight bits for the first sample on CH1.

CHSEL is then set HIGH which enables IC3. The PC then repeats the procedure with DSEL for CH2, and then pulses the INCA line to increment both FIFOs to their next address. This procedure is repeated until all addresses in the FIFO's have been read. Note that the PC is unable to go back and re-read an address once it has incremented the INCA line, so it only gets one chance at reading the data.

The two 8-bit latches IC5 (data latch A) and IC6 (data latch B) serve two functions. The first is to provide more outputs than the parallel port can provide (we need 15, and the parallel port only has 12), and the second is to eliminate any problem with line noise, which can be a problem particularly with the INCA line.

Both latches are fed with the same data from the eight data bits on the parallel port. Data is then clocked into IC5 when pin 14 on the parallel port is pulsed, and IC6 when pin 1 is pulsed. This data is then latched on the output of IC5 and IC6 to provide the 15 control signals required by the DSOA. R1 and R2 are used to keep the latch clock lines 'rigid'.

The six relays that control the vertical attenuation for both channels are controlled by six control lines from data latch A. As mentioned earlier each relay is driven by its own control line via IC25 (ULN2003A), a seven-way Darlington driver. A TTL level HIGH signal on a data input to the ULN2003A enables a high current output sink to the GND pin on the corresponding output. An array of seven diodes is built into the ULN2003A to provide protection against back-EMF from the relays; the common of these diodes is connected to +12V.

Sampling clocks

THE MAIN SAMPLE clock is derived from X1, a 20MHz crystal oscillator module. This clock is then divided by 2, 10, 20, 100, 200, 1000 and 10000 by IC11 and IC12 (dual decade counters). All of these clocks are then fed into IC13, an 8-input mux. One of these clocks is selected as the main sample clock by the three control lines CLKS0-3 which are controlled by the PC.

You may be wondering how these eight frequencies can be used for 18 different timebase frequencies. The answer lies in the software, which is able to calculate the best sample frequency for each timebase setting given the size of the RAM. If we had a big enough RAM we would only need one or two sample frequencies to cover the entire timebase range.

In fact, even with a 1KB RAM we could cover all of the ranges with three sample frequencies, but this would only give two or four samples per division on some ranges. We also wouldn't have much scope to add the dual timebase facility on these ranges. The eight frequencies were chosen as a reasonable compromise, and provide at least 40 samples per division resolution on all but the four fastest timebase ranges.

The power supply is conventional and consists of three three-terminal regulators, one each for the +5V, +12V, and -12V supplies. The +12V and +5V regulators are driven from the half wave rectified input of D1 and C17. The -12V rail is driven from the other half wave rectified input of D8 and C18. Adequate heatsinking must be provided on the +5V regulator, due to its high voltage drop and significant power dissipation.

In the photos and diagrams next month, you'll notice the split in the ground plane on the bottom centre of the PCB. This separates the digital and analog ground connections and prevents switching noise from the digital section interfering with the analog circuitry. You will also notice that the +5V regulator powers both the ADC analog supply and the digital electronics. This is possible because separate supply tracks are run from the +5V regulator to the ADC analog supply pins. This eliminates the need for an additional +5V regulator just for the ADC's.

In the second article, we'll cover construction, testing and setup of the new DSO Adaptor.

(To be Continued) ❖

Parts List

Resistors

R1-3,5,7-9, 12,16,31,35, 38,39,41	1k 1%
R4,6,40	47 ohms 1%
R10,37	2.2k 1%
R11,36	82k 1%
R13,34	68 ohms 1%
R14,20,27,33	470 ohms 1%
R15,32	4.7k 1%
R17,30,42	100k 1%
R18,29	220k 1%
R19,28	680k 1%
R21,26	220 ohms 1%
R22,25	1.5k 1%
R23,24	390 ohms 1%
R43,44	6.8k 1%
VR1	1k linear pot
VR2,3	10k linear pot

Capacitors

C1	2200uF 25VW RB electrolytic
C2	680uF 25VW RB electrolytic
C3-32,100,101	0.1uF monolithic (0.2 pitch)
C33,35,36	10uF 16VW tantalum (0.2 pitch)
C37,38	5.6pF ceramic (0.1 pitch)
C39,40	150pF ceramic (0.1 pitch)
CV1,2	5-30pF trimmer

Semiconductors

D1,8	1N4002 diode
D2-7	1N914 diode
LED1	5mm LED (red)
IC1,2	AM7202A-35RC (Skinny DIP)
IC3,4	74HC257 quad multiplexer
IC5,6	74HCT574 octal latch
IC7	74HC107 dual J-K flipflop
IC8	74HC74 dual D flipflop
IC9	74HC86 quad XOR gate
IC10	74HC20 dual 4-input gate
IC11,12	74HC390 dual decade counter
IC13	74HC151 8-input multiplexer
IC14,23	TDA8703 flash A-D converter
IC15,16,21,22	LM6361N high speed op-amp
IC17,20	AD744 high-speed op-amp
IC18,19	LM741 op-amp
IC24	LM319 comparator
IC25	ULN2003A relay driver
REG1	7805 regulator (TO-220)
REG2	7812 regulator (TO-220)
REG3	7912 regulator (TO-220)

Miscellaneous

X1	20MHz xtal osc. module
PCB	PCB 226 x 119mm, code DSOA331
T1	12.6V/500mA transformer
RLY1-6	12V DPDT mini DIL PCB relay (Matsushita TQ2 or similar)
S2,4	SPDT centre off mini toggle switch

Case, 260 x 180 x 65mm, metal with aluminium front panel; 100 x 100mm piece of blank copper-clad PCB; 8 x 8-pin dual wipe IC sockets; 10 x 14-pin dual wipe IC sockets; 6 x 16-pin dual wipe IC sockets; 2 x 20-pin dual wipe IC sockets; 2 x 24-pin dual wipe IC sockets; 1 x 26-way IDC header socket; 1 x 26-way dual row pin header (CN1); D25 IDC socket; three instrument knobs; 2 x BNC sockets, panel mount; IEC mains socket, fused panel mount type; small TO-220 heatsink, U-type (for REG1); 4 x PCB standoffs; 300mm length RG-174 coaxial cable; 150mm length 26-WAY ribbon cable; tinned copper wire, solder etc.

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Tandy ELECTRONICS

READER INFO NO.16

ZULU.TA205.E

$10 Wonders

16 - Precision temperature alarm

This circuit sounds a buzzer whenever the temperature exceeds a pre-set level. You can use it to monitor the deep-freeze, or the greenhouse in summer, or use it as a fire detector, or to sound the alarm when the room temperature falls below a given level.

OTHER USES include a frost alarm in the garden, or you can set it up to check that the beer in the fridge has cooled down to a drinkable temperature, or to check that the pool temperature is not unbearably low. As you can see, there are heaps of practical uses for this alarm; so turn on that soldering iron and read on...

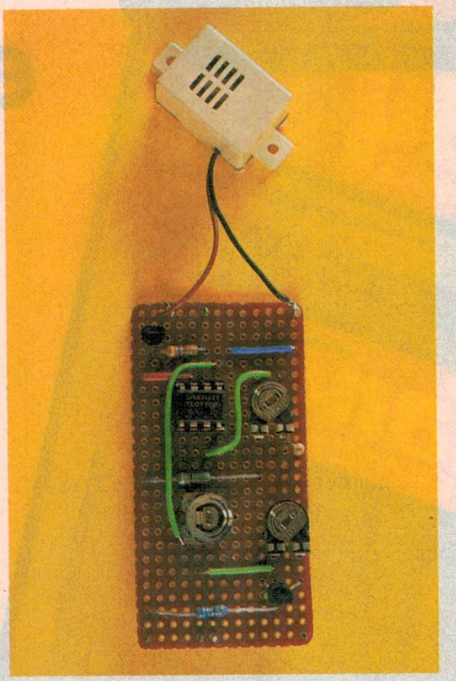
Circuits of this type are generally based on a thermistor, but a thermistor has a non-linear response, which makes it difficult to calibrate the circuit. So instead this circuit uses the LM335Z band-gap IC, which gives a readout that is very easy to turn into degrees Celsius. (Yes, 'Celsius', please, not 'Centigrade'. Why should we forget the man who invented the scale we all use, while the man who invented the now-obsolete Fahrenheit scale is still remembered?)

Internally, the band-gap IC is is constructed along the lines of a Zener diode, but it is a little more complicated and ingenious than that. It contains two transistors and there are two parts to the circuit, one with a positive temperature coefficient and one with a negative temperature coefficient. If the internal biasing resistors are accurately trimmed, the two coefficients cancel out and we have a band-gap voltage reference, equivalent to a Zener diode and used for the same purpose.

It is possible, however, to set the coefficients so that they do not quite cancel out, but leave a positive temperature coefficient of exactly 10mV/°C. The LM335Z has just such a configuration, so that the voltage at its positive terminal is equal to one hundredth of the temperature in kelvin (another famous name).

On the kelvin scale, zero degrees celsius is 273K. To work in kelvin all you have to do is add 273 to the celsius value, then divide by 100 to get the voltage output of the LM335Z. For example, 20°C is equivalent to 293K, and the output of the IC at that temperature is 2.93V. Another example; normal body temperature is 37°C, equivalent to 310K, and the output is 3.10V. When used with suitable circuitry, this IC is capable of measuring temperatures to better than +/-1K.

A rather more pricey version of this IC (too expensive for a $10 Wonder) is the LM35CZ. The output of this is directly proportional to celsius temperatures. For example, it is 20mV at 20°C and 37mV at 37°C.



The Precision Temperature alarm is shown here with a simple 9V buzzer, but there is no reason why you couldn't replace it with a relay or other warning device — such as one presented in an earlier $10 Wonder.

It also has greater precision, about +/-0.4°C at 25°C.

How it works

R1 PROVIDES a current of about 1mA through IC1, while VR1 is connected to the 'Adjust' (ADJ) terminal of the band-gap device. This trimpot can be omitted, leaving ADJ unconnected, but the precision of the circuit will fall to +/-2°C.

The output from IC1 is taken to the inverting terminal of IC2, which is an op-amp with JFET input. This is wired as a comparator, the non-inverting terminal being connected to VR2. VR2 is part of a resistor chain, with the values of R2 and R3 chosen so that the voltage available at the wiper of VR2 covers a useful temperature range. With the values as shown in Fig.1 the voltage range is from 2.68V to 3.37V. The corresponding temperature range is 268K to 337K, or from -5°C to 64°C. (You can change these values to suit the temperature range you'll be using, but bear in mind that the LM335 will operate over the range of -40 to +100°C.)

A problem with this circuit is that a millivolt is equivalent to one degree, so the comparator needs to have a precision of

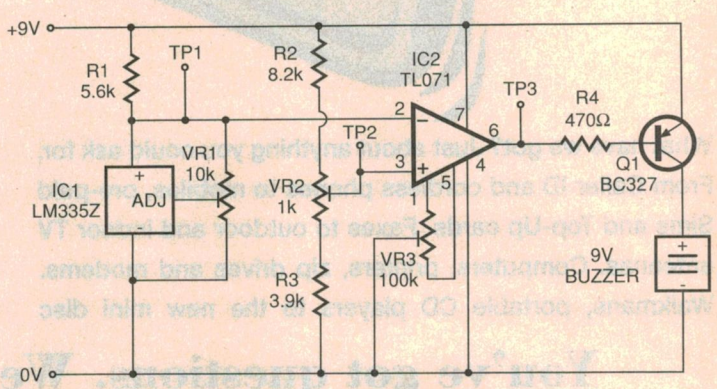


Fig.1: IC2 is used here simply as a comparator, sensing if the voltage from the sensor exceeds the voltage set by VR2. VR3 allows you to null out the opamp's input offset voltage, which will give the circuit an accuracy of less than one degree.

1mV or better. Unfortunately, op-amps are subject to input voltage offset. The output of the comparator is zero not when the two inputs are exactly equal, but when there is an offset between them. For the TL071C, the input voltage offset is typically 3mV, equivalent to three degrees celsius.

To avoid this difficulty we could use an op-amp with smaller input offset, such as the more expensive OP27 (for which the offset is only 0.22mV), but instead we are providing an offset null adjustment in the form of VR3, which allows us to 'tune out' the offset. Of course, if you are willing to have an error of up to 3°C in the circuit, you can omit VR3 altogether.

The circuit shown in Fig.1 switches on the buzzer when the temperature of IC1 exceeds the trigger value set by VR2. If the temperature is below the trigger level, the voltage at the negative input of IC2 is lower than that at the positive input, and so the output of IC2 is high, close to 9V. Note that Q1 is a PNP transistor, so that a high input switches it off. As the temperature rises above the triggering level the voltage at the negative input becomes greater than that at the positive input. The output swings low (to about 1.3V) and Q1 turns on, sounding the buzzer.

Construction

BEGIN BY assembling the sensor circuit, comprising R1, IC1, VR1, the wire link between L6 and E6 and the terminal pin at E1 (Fig.2). The terminal pin is a test point (TP1) which we will use when checking construction and later when setting up the circuit.

Test the assembled sensor circuit by applying power to it and monitoring the voltage at TP1 (relative to the 0V line). It should be in the region of 3V (for a room at 25°C). Touching the IC with something warm should then make the output voltage rise. You should also be able to alter the voltage by +/-600mV by adjusting VR1.

Next assemble the voltage divider chain R2, VR2, R3, TP2 and the wire link from L20 to F15. Note the cut strips at K12, L13 and M13. Check this section by measuring the voltage at TP2 while VR2 is turned over its full range, to obtain a voltage range from 2.68V to 3.37V, or thereabouts.

The op-amp is the next stage for assembly, including VR3, TP3 and the wire link between H23 and N23 — and note that all four strips are cut under the IC. With this stage of the construction completed, check the output of the op-amp by measuring the voltage at TP3. The output can be made to swing between about 3.6V and 8.4V by altering the settings of the trimpots.

Complete the circuit by soldering R4, Q1 and the buzzer. Eventually you will need to mount the buzzer (or siren, or even an AWD from a previous $10 wonder) on a firm support such as the wall of the enclosure, to obtain maximum volume.

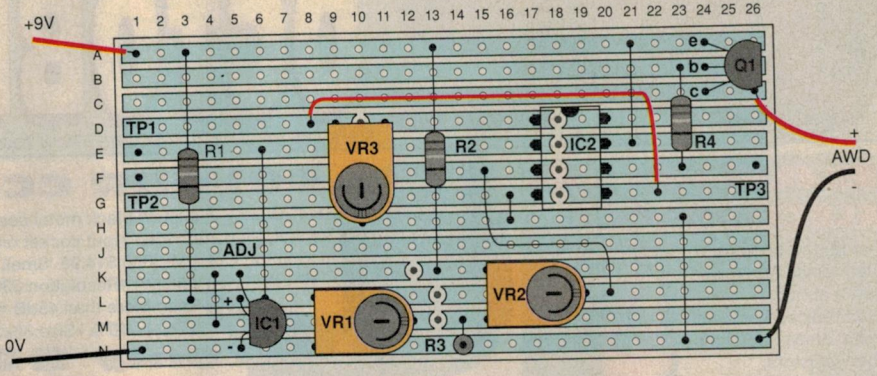


Fig.2: There's nothing special on the construction side of things — just take care of the orientation of IC1, IC2 and Q1. Don't forget to cut the track at D10, as it is rather hidden by VR3. While the circuit runs off a 9V battery, you could use a 9-12VDC plugpack if you intend to drive relays or have the unit running for an extended period of time.

Q1 can switch a maximum of 800mA, so it is capable of driving a powerful solid-state siren if you want a loud warning. It could also switch a relay (this circuit is basically a thermostat) so you could use the relay to turn on a fan when the room gets too hot. (I'd stick to switching a low-voltage 12V muffin fan and steer clear of any 240V mains switching though, for safety reasons.)

The circuit can be easily modified to sound the alarm when the temperature falls *below* the trigger value instead of above it. The only changes are that the wire link from L6 goes to F6 and the link from L20 goes to E15. In the assembly and setting up instructions read 'TP2' for 'TP1' and 'TP1' for 'TP2'.

Setting up

WHEN YOU are happy with the circuit's operation, you'll need to set up and calibrate the alarm by going through the following procedure:

1. Temporarily connect TP1 to TP2, so that both inputs to the op-amp are at equal voltage. Monitor the voltage at TP3 and adjust VR3 until the output is as near as you can get it to 4.5V (half the supply voltage), Then disconnect TP1 from TP2.
2. Use a thermometer to measure the room temperature and calculate what the output of IC1 should be. While measuring the voltage at TP1, adjust VR1 to bring the voltage to the correct value.

(A handy hint — ice melts at 0°C, so a glass full of melting ice cubes will give you a useful reference at the bottom end of the scale.)

3. Decide on the trigger temperature and calculate the corresponding voltage. Connect a voltmeter to TP3 and adjust VR2 to obtain the required voltage. The buzzer will sound whenever the temperature of the sensor exceeds that value.

Normally it is not necessary to repeat steps 1 and 2, but step 3 may be repeated if you want to use the circuit in other applications. ❖

Parts List

Resistors

Metal film 1% 0.25 W

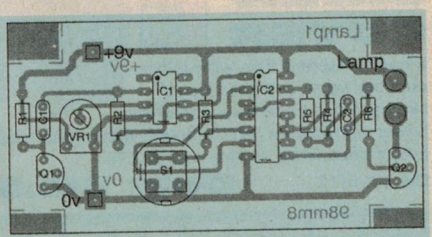
R1	5.6k
R2	8.2k
R3	3.9k
R4	470 ohms
VR1	10k mini trimpot
VR2	1k mini trimpot
VR3	100k mini trimpot

Semiconductors

IC1	LM335Z precision temperature sensor
IC2	TL071C BIFET operational amplifier
Q1	BC327 PNP transistor

Miscellaneous

Solid-state buzzer or siren, stripboard 35mm x 68mm (13 strips x 26 holes), 7 x 1mm terminal pins, 8-pin ic socket, battery clip or battery holder for 9V battery.



For those of you who were thinking of building the Mailbox Monitor back in the August 1998 issue, you'll be happy to know that RCS Radio are now selling a PCB for the project. Measuring 28 x 43mm and coded 98mm8, this board will fit in a compact case and make construction easier. To order a board, contact RCS Radio, 651 Forest Rd. Bexley 2207, or phone (02) 9587 3491.

Jaycar ELECTRONICS

SUPER VALUE OCTOBER SALE

Prices valid until October 31st.

All prices in Australian Dollars - New Zealand customers please ask for New Zealand prices.

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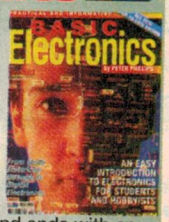
NEW in 98



Brand new book from Electronics Australia. Learn about Electronics. Starts with volts, amps and ohms, then resistors, batteries, inductors, capacitors, diodes, power supplies, transistors, amplifiers and ends with an introduction to digital electronics. Stacked full of vital information for those interested in learning about electronics. Great price! 114 pages. Cat. BE-5050

Only $5.95

COLOUR CCD CAMERA

NEW in 98

1/4" Digital, in a small black metal case. Supplied with a BNC socket and DC power socket. Plug into video input socket on VCR or TV, or through RF antenna with a video modulator. Cat. LM-3850 $14.95. Small Size!! Specifications: •Pick up elements:1/4" CCD •Pixel:512(H) x 582(V) •Resolution:330 TV lines •Min Illumination:5 Lux/F2.0 •S/N Ratio:More than 45dB •Broard Lens:f3.6mm/f2.0 .70°Angle •Power Source: 12VDC +/-10% •Size:36x36x15mm. Cat. QC-3482

Only $249.50

EXTREMELY LARGE DIGITAL CLOCK WITH HUMIDITY, TEMP & CALENDAR

NEW in 98

Ideal for office, factories, homes, wine cellars etc. Includes: •Humidity sensor •Temperature in °C and °F •Calendar with day, date and month •Huge display 146(w) x 95(H) •Overall size 210(W) x 210(H) x 25(D)mm. Cream and silver in colour, operates on 2 AA batteries (not supplied)

Cat. XC-0232 **Only $99.95**

CAT 5 SINGLE STRAND CABLE

NEW in 98

Single strand Cat 5 is used for long runs, where as multistrand (WB-2020) is used for patch leads and short runs. Blue in colour. Cat. WB-2022

95¢ mt. or $75 per 100 mt. roll

BUDGET COMPUTER TOOL KIT

NEW in 98

Includes •IC inserter •Blank hex driver •Reversable bits •T10/T15 driver bit •Phillips 0 & 1/8" slot bit •Phillips 1 & 3/16" slot bit •Nut drivers 3/16" & 1/4" •Spare parts tube •Pearl catch •Tweezers •IC extractor. Cat. TD-2039 **$17.95**

GME Kingray 4 WAY INDOOR TV/FM AMPLIFIER

NEW in 98

Boost your signal for up to 4 TV's with this indoor mains powered booster. UHF gain is 10dB, VHF gain is variable. Made in Australia. Uses 75Ω TV sockets.

Cat. LT-3286 **only $99.95**

FIG 8 AUTO CABLE

NEW in 98

15 amp 2/26 x 0.3mm. Red/Black figure 8 auto cable.

Cat. WH-3078 **$1.20mt.**

$100/100mt. Roll

SELF AMALGAMATING TAPE BARGAIN

NEW in 98

This tape is polyisobutylene, and "cures" to a single mass once it is taped. Its ideal for sealing, waterproofing & insulating. It is made in England by BICC. Roll size is 25mm wide x 10mtrs long. (We currently sell a roll 20mm wide x 5 mtrs long for $14.95). Limited qty.

Cat. NM-2826 **Only $24.95**

DURATECH TEMPERATURE CONTROLLED SOLDER STATION

NEW in 98

Our best ever imported soldering station has arrived. Features quality 60W solder pencil with silicone rubber cord, adjustable temperature from 150 - 450°C, 6 sponges supplied . See Cat. P113 for details.

Cat. TS-1380 **$189**

PLASTIC SIREN COVER

NEW in 98

It had to happen! This will replace our steel version. Will accept 5" siren and has three holes for strobe. 5 year warranty for UV. Complete with tamper switch. Lower price, steel version was $29.95.

Cat. LA-5112 **Only $19.95**

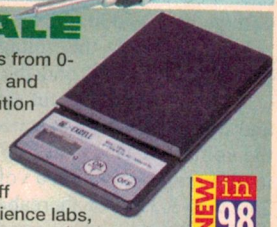
NEW LEDS

Green 5mm 2200MCD 3.6V Cat. ZD-1784 **$7.95**

White 5mm 1800MCD 3.6V Cat. ZD-1787 **$7.95**

NEW in 98

MINI SCALE



This digital scale measures from 0-50g with resolution of 0.1g and from 50-100g with a resolution of 0.2g and has a max. capacity of 100g. It also features a late/net weight function and auto power off which makes it ideal for science labs, pharmaceutical applications or weighing precious stones and metals, herds, chinese medicines etc. Amazing small size-only 146L x 80W. Calibrated in Australia. Supplied in a pouch. Cat. QM-7248

NEW in 98

0.1g Resolution

$199

RJ45 BOOTS

NEW in 98

A packet of 4 boots to suit RJ45 8/8 plugs. Includes 2 blue and 2 grey boots. Cat. PP-1440

$1.98

TEMPERATURE ADJUSTABLE SOLDERING IRON BARGAIN

Grab a spare at this silly price! Adjust from 250°-450°. 30 watt ratio. Cat. TS-1460

Normally $49.95

Now $37.95 Save $12

SVHS LEADS

4 pin "S" Plug to " S" Plug. Gold connectors, 4 pins wired. 2 lengths available.

1.5m Cat. WA-1105 **$9.95**

3.0m Cat. WA-1106 **$11.95**

NEW in 98

HEATSHRINK PACK BARGAIN!!

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Limited quantity available.

Includes 14 pcs. of 55mm long white heatshrink, that you can write on (before heating) to identify leads etc. of diameters range from 4 to 25mm. Also includes 1/2mt. of standard black 25mm dia. heatshrink.

Cat. WH-5520 **Only $3.95**

BUY 5 OF A PRODUCT WORTH $100 OR MORE LESS 10%

OVERNIGHT DELIVERY

RE/SPONSE 15" WOOFERS

You wanted them, so here they are! There is a 4 ohm version and an 8 ohm version. They have a pressed paper cone (the best we feel for a 15" driver) & a rubber surround. The voice coil is the usual Re/sponse high quality kapton type, & the magnet weighs a huge 1.8kg. They are ideally suited for that big woofer project & in the correct bass reflex enclosure, will give thunderous performance to very high SPLs

4 ohm •Nom impedance - 4Ω •Power handling - 250 watts RMS •Frequency range - 23-2000 hertz •Sensitivity - 95dB 1 watt, 1 metre •Voice coil resistance (Re) - 3.5Ω •Resonant frequency (fs) - 23 hertz •Mechanical Q factor (Qms) - 4.06 •Electrical Q factor (Qes) - 0.304 •Total Q factor (Qts) - 0.283 •Equivalent volume (Vas) - 500 litre •Cone area (square metres) - 0.085 •Magnet weight - 60oz (1.89kg) •X-max (mm) - 4.5mm •Voice coil inductance (Le) - 0.87mH (at 1k)

TYPICAL APPLICATION Vented box •Box volume (litres) - 160 •Tuning frequency (Hz) - 30 •-3dB frequency (Hz) - 36 Two vent options: *Vent diameter - 150mm •Vent length - 265mm •2 vents dia. - 110mm •Vent length - 292mm •Inside cabinet dimensions - 470(W) x 800(H) x 450(D)mm

SMALL BOX FOR CAR (15" 4 ohm) Vented Box •Box volume (litres) - 80 •Tuning frequency (Hz) - 30 •-3dB frequency (Hz) - 40 Vent options: •Vent dia. - 110mm •Vent length - 236mm •Inside cabinet dimensions: 470(W) x 600(H) x 300(D)mm.

SEALED BOX •Box volume (litres) - 130 •Tuning frequency (Hz) - 50.67 •-3dB frequency (Hz) - 49 •Qtc - 0.62 •Inside cabinet dimensions: 450(W) x 750(H) x 400(D)mm

4Ω model Cat. CS-2248 $299.50 NEW in 98

Speaker dimensions: A - 385mm, B - 370mm, C - 350mm

8 ohm •Nom impedance - 8Ω •Power handling - 250 watts RMS •Frequency range - 18-2000 hertz •Sensitivity - 94dB 1 watt, 1 metre •Voice coil resistance (Re) - 6.3Ω •Resonant frequency (fs) - 18 hertz •Mechanical Q factor (Qms) - 5.266 •Electrical Q factor (Qes) - 0.303 •Total Q factor (Qts) - 0.286 •Equivalent volume (Vas) - 750 litre •Cone area (square metres) - 0.085 •Magnet weight - 60oz (1.89kg) •X-max (mm) - 4.5mm •Voice coil inductance (Le) - 1.42mH (at 1k)

TYPICAL APPLICATION Vented box •Box volume (litres) - 221 •Tuning frequency (Hz) - 25 •-3dB frequency (Hz) - 29 •Two vent options: *Vent diameter - 150mm *Vent length - 280mm •2 vent dia. - 110mm •Vent length - 300mm •Inside cabinet dimensions - 450(W) x 850(H) x 600(D)mm

SMALL BOX FOR CAR (15" 8 ohm) Vented Box •Box volume (litres) - 100 •Tuning frequency (Hz) - 30 •-3dB frequency (Hz) - 38 •Vent options: •Vent dia. - 110mm •Vent length - 170mm •Inside cabinet dimensions: 470(W) x 600(H) x 380(D)mm

SEALED BOX •Box volume (litres) - 152 •Tuning frequency (Hz) - 44 •-3dB frequency (Hz) - 44 •Qtc - 0.707 (Butterworth Response) •Inside cabinet dimensions: 440(W) x 790(H) x 460(D)mm.

8Ω model Cat. CW-2148 $299.50 NEW in 98

MOTOROLA CELLULAR BAG PHONE BATTERY NEW in 98

Genuine Motorola 12V sealed lead acid battery, No. SNN4139A. Size 181(L) x 60(H) x 22(W)mm. Limited quantity available. Be quick.

Grab a spare. Cat SB-2595 **$69.95**

We have a very small quantity of Motorola mains chargers for this battery. Type SPN4193C. See Mail Order Corner.

LOCKING NUTS FOR D CONNECTORS NEW in 98

These are long screws, suited for in line joining of D connectors. Screws are 18mm long. Packet of 10 screws, washers and nuts. Cat. PM-0853

Pkt 10 $3.50

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SYNCHRONOUS MOTOR DEAL NEW in 98

This small motor is rated at 220V 50Hz and 250RPM. Size is 51 (dia.) x 12 (H) mm. Spindle is 5mm long & 1.4mm dia. Limited quantity available. Cat. YM-2702

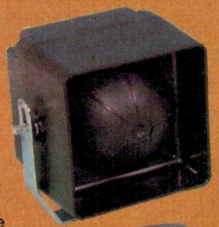
Only $5 each.

VELCRO STICKY PADS NEW in 98

A pack of genuine velcro sticky male and female pads. 12 of each. White in colour 22mm diameter.

Cat. CF-2764 **$2.95**

ALL IN ONE CAR ALARM WITH LEARNING REMOTE



A great new alarm thats both simple to use and install - just two wires to connect (power and ground!) or three wires with the use of an optional tamper switch! Features include: •5 selectable siren tones, selectable via the remote control •Optional door/bonnet switches can be connected •Single button arm/disarm/panic •Shock sensor warning tone if vehicle is accidentally bumped •Arm/disarm verification tones •Panic button can be used when in/out the car •Code learning remote controls •Current sensing input available. Spare code learning remotes Cat. LA-8982 $19.95

Cat. LA-8980 **$89.50**

MIL-SPEC SWITCHMODE POWER SUPPLY

LAMBDA ELECTRONICS INC U.S. made, 5, 12, 24V remote voltage sensing. Another spectacular surplus stock purchase. Industry leader Lambda Electronics Inc. 100 watt switchmode power supply. Note These are not surplus power supplies out of PC's - They are made to MIL-STD-810E (vibration) and conform to an unbelievable number of international standards. The model (Lambda SVS100-5-001) is rated at 100 watt output. This means that you can pull 20 amps at 5V, 8.3 amps at 12V or 4.3 amps at 24VDC up to a total of 100 watts. The unit is short circuit proof and will operate from AC mains voltages of 85-264V 47-63Hz! The entire unit is enclosed in a ventilated metal box, with input terminals via a standard molex 0.156" pitch connector. Features: •No fan cooling assistance required •Fantastic line and load regulation •Case dimensions: 190(L) x 120(W) x 50(D)mm •Class "B" VDE and FCC EMI filtering •0.03%/°C temperature coefficient •Remote voltage sensing (if required) •Output short circuit protection •Mains overvoltage protection •Full instructions and data included. Jaycar only has a modest quantity of these so be quick! No Rain Checks!

NEW in 98

First in to see will buy. Cat. MP-3046 **Only $89.00**

BANANA PLUG TEST LEAD BARGAIN NEW in 98

Another surplus stock purchase. This is a shielded lead with 2 high quality piggy pack style banana plugs on one end to a strange 2 pin plug on the other. Length is 1.5mts. If the plug is removed, and replaced with alligator clips, you will end up with a useful test lead. Limited qty avail.

Cat. WT-5322 **$3.95**

MOTOROLA "BRICK" GENUINE BATTERIES

7.5V Nicad battery Don't pay $50! These are now very scarce! Brand new stock. Cat. SB-2565

OLD

Only $20ea

ZIP DISKS

Now available at Jaycar. 100mb IBM formulated. Cat. XC-4760 NEW in 98

$29.95ea

10+ less 10%

REWRITABLE CD

Precisa 74min. 650mb. Cat. XC-4720 NEW in 98

$39.95

3 IN 1 DETECTOR NEW in 98

A quality tool that will find wooden studs, metal, nails, screws and voltage. When anything is detected, a LED will light up next to the corresponding symbol - & a buzzer will sound. Includes a 2 way switch, one position for studs, the other for metal & voltage. Also has a low battery warning. Uses a 9V battery not supplied. Size 175x38x23mm. Cat. QP-2280

Only $29.95

LASER POINTERS MAX LEGAL POWER

Cat. ST-3100
PEN TYPE
$29.95
SAVE $10

KEYRING TYPE

Cat. ST-3102

$29.95
SAVE $10

NEW CELLULAR BATTERIES

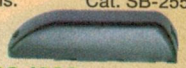
NEW in 98

NOKIA 1610

Ni-Mh 1200mAh.
Standby 100 hours.
Talktime 360 mins.
$49.50
Cat. SB-2552

NOKIA 3110/3810

Ni-Mh 1200mAh. Standby 120 hours.
Talktime 280 mins. Cat. SB-2553



$49.50

NOKIA 6110

Ni-Mh 950mAh.
Standby 80 hours.
Talktime 280 mins.
$59.50
Cat. SB-2554

ERICSSON 628/688

Ni-Mh 1200mAh. Standby 100 hours.
Talktime 360 mins. Cat. SB-2576

$49.50

ERICSSON 788

Ni-Mh 600mAh.
Standby 30 hours.
Talktime 90 mins.
$49.50
Cat. SB-2577

NEC FIDO

Ni-Mh 1200mAh. Standby 60 hours.
Talktime 180 mins. Cat. SB-2582

JAPANESE CELLS, ASSEMBLED IN TAIWAN
$49.50

CAT 5 UTP SPLITTER

NEW in 98

RJ45 plug to 2 x RJ45 sockets. Accommodates 2 services over the one cable. Typically a single 4 wire telephone & a standard Ethenet computer, or 2 PC's can be used over one cable. Standard wiring. Length 150mm.
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MIXED SEMICONDUCTOR PACKS

We had so many surplus semis, we have decided to make two different packs! Both new!!! Buy both, and get even more variety for your parts box.100 semi's in each pack!!! Note: Picture is representation only.

Pack #1 Cat ZP-8990
Pack #2 Cat ZP-8991

NEW BATCH

$10 per pack

UNIVERSAL IN-DOOR POWER WINDOW KIT

Install your own power windows. Suitable for 2 windows. (For 4 windows use 2 kits). Cat. LR-8840

Normally $249
October $219 Save $30

Jaytech 6500 8 SECTOR COMPREHENSIVE ALARM SYSTEM

SAVE $$$$

Ideal for larger houses or simply those that demand the ultimate protection at an amazing price. This is a pro system that would cost a fortune if it was installed by a specialist alarm installer. Do it yourself and save a bundle! See page 77 of '98 Catalogue for full details.
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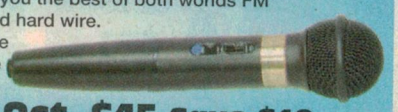

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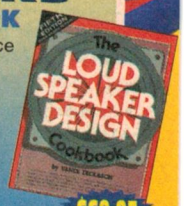

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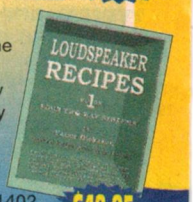

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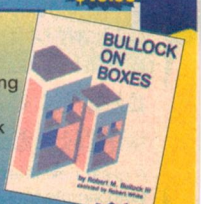

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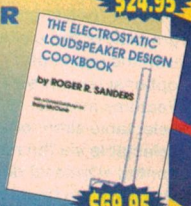

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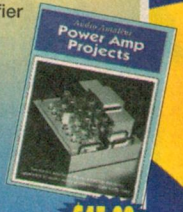

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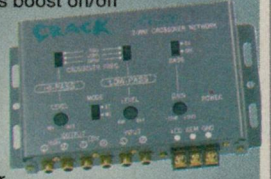

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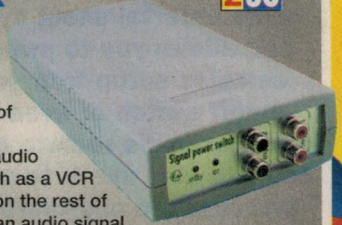

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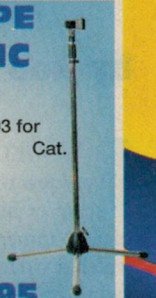

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Construction Project

Signal-controlled Mains Power Switch

Use our new Signal Power Switch to automatically apply mains power to your audio-visual gear, under the command of just one 'master' unit, such as a VCR or CD player. It's ideal for all but the simplest home entertainment systems, and allows you to power-up a complex setup from just one on/off switch or even via the master unit's remote control. You can also use it to activate inaccessible subwoofer amps and outboard signal processors — or for that matter, just about any piece of gear that needs to be on when audio signals are present...

by Rob Evans

IT WOULD BE fairly safe to assume that very few of us have a home entertainment setup or hifi system which can be conveniently turned on with just one switch. To watch a video tape for example, you need to switch on the VCR, then the TV receiver, and in many cases follow this by powering up a home theatre system, your hifi, or some other sound system attached to the VCR's audio outputs. Easy to do, of course, but messy...

The more elaborate hifi systems generally need a number of separate units switched on too, including preamps, power-amps, subwoofer amps, and so on. If aesthetics or perhaps spouse pressure have forced the power amps onto hiding, you then end up having to open a cupboard or dig into the back of a shelf to switch on these parts of the system — *that's* undeniably messy...

Our new low-cost Signal Power Switch was developed with these complications in mind, and solves the problem quite neatly by monitoring the audio output of a master unit, then activating its own 240V AC outlet when even small signals appear at its input. So that it doesn't shut off the power after an extended section of quiet music, the Power Switch also includes a 'timeout' delay which can be preset to 3.5, seven or 14 minutes using internal jumper links.

In practice then, it's just a matter of connecting a signal lead from the audio output of the nominated master unit to the Power Switch's input, then powering the 'slave' units from its 240V outlet lead. It has two input 'channels' by the way, and each of these has two linked RCA sockets so that it can be connected in series with an existing signal path. Also, both input channels can be used in the one setup, so the system can be triggered by (say) either the VCR *or* your CD player.

There's one lurking potential problem with the concept used in the Power Switch though, and that's the risk of self-triggered cycling — or if you like, extremely slow 'motor-boating'. This can occur when the device shuts off power to a slave unit, which in turn causes a transient signal in the master unit. This interference signal then retriggers the signal-sensing device, which immediately applies power to the slave again... We therefore have a self-sustaining power on/off cycle, repeating at the device 'timeout' rate.

To eliminate this possibility we've added a 'lockout' feature to the Power Switch, which disables the signal sensing stage for a short period after the circuit has timed-out and shut off the 240V outlet. For the next 12 seconds after this event, signals at the unit's input (including any interference transients) are ignored, and only then does the circuit return to its standby or 'armed' state. A front panel LED (standby) flashes during the lockout period, so the user knows that the Power Switch is ignoring input signals for a short time.

The overall setup works very well in practice, and the Signal Power Switch should be a useful addition to many audio-visual and hifi systems. The circuit uses common low-cost components and is easy to assemble, and could even be installed inside an existing unit such as a subwoofer amplifier. In this case it can only power-up the amp itself, but the amp can then be shoved back in the cupboard where it will now take care of its own power switching...

Circuit details

THE POWER Switch's circuit can be divided into two main sections: the signal sensor stage formed around op-amp U1, plus a timer stage comprised of the counter/oscillator U2 and latches U3a and U3b. As you can also see from the schematic diagram (Fig.1) the circuit ultimately controls the action of relay RLA, which passes the 240V AC supply to the mains output socket when an audio signal has activated the unit.

In more detail, signals at IN1 and IN2 are applied to the signal sensor preamp (U1, pin 3) via isolating/mixing resistors R1 and R2, plus coupling capacitor C1 and terminating resistor R4. Here, the TL071 is set to a gain of about 1200 by feedback resistors R6 and R5, while the stage's high frequency response is restricted to around 9kHz by C4.

A DC bias voltage for the preamp is generated by the voltage divider R8, R9 and trimpot RV1, which delivers a fixed level to the op-amp's input terminating resistors R4 and R5. This bias voltage is bypassed by electrolytic C5 and can be varied between about 4V and 8V by RV1 (more on this later), while the op-amp's supply pin is decoupled from the +12V rail by filter components R3, C2 and C3.

With this bias arrangement an amplified version of the input signal will appear at the op-amp's output, but superimposed on a standing DC level as set by RV1 — the circuit's trigger sensitivity adjustment. The composite AC/DC signal is then passed to the following *digital* stages (U2 and U3a) via filter components R7 and C6, which again restrict the signal bandwidth to around 9kHz.

CMOS chips U2 and U3 will have an input threshold voltage of around 6V here (half of the supply), so if RV1 is set for a preamp DC output of (say) 5V, then an AC signal of 1V peak will be enough to trigger the following CMOS chips. As a result, an audio signal of just a millivolt or so at the unit's input will ultimately reset U2 (pin 12) and clock U3a (pin 3).

Before moving on to the next sequence of events though, we should consider the quiescent state of the timing and latching circuit U2 and U3.

The 4060 divider/oscillator chip (U2) is normally in a 'free-run' condition since its reset input (pin 12) is at a digital low, so its divider outputs will cycle through at a rate determined by oscillator components R10, C7 and R11 — in practice, 10Hz. Note that these outputs will have no real effect while the circuit is in its standby condition.

The first section of the 4013 dual D-type flipflop (U3a) will start in a reset state thanks to power-on reset components C8, D2 and R12. Here C8 lifts U3a's reset line (pin 4) as the supply rail first rises, then charges to a low level via R12 and the output of U2 (D2 safely discharges C8 when the circuit is shut down). Note that U3b may start in any state, but is soon reset by the cycling action of U2's Q7 output (pin 14), which is tied to U3b's reset line (pin 10).

In the circuit's steady state then, both latches will be reset while the main clock/divider stage (U2) is cycling freely. Other than that, the user is shown that the unit is in its standby mode by the action of LED1, which is connected between the Q-bar and Q outputs of U3a and U3b respectively, via current limiting resistor R13 and isolating diode D3. As both latches are reset, their Q-bar lines will be high while the Q outputs are low, so LED1 is held on during the unit's standby phase.

When a small audio signal appears at the unit's input however, the amplified version at the preamp's output will reset U2 and clock U3a, as mentioned above. The high level at U3a's data input (pin 5) will therefore be clocked to its output (the D latch is now set), and the resulting high at pin 1 (Q) biases transistor Q1 hard on via R15. This in turn engages the output relay RLA, where its contacts pass the 240V mains supply to the mains out socket.

At this time, the high at U3a's Q output will activate the 'on' indicator (LED2) via resistor R14, while LED1 (standby) is no longer activated by U3a's complementary Q-bar output (pin 2). Note that R16 drops the 15V 'raw' supply rail down to around 12V for RLA's coil, while D5 suppresses the backswing voltage generated by the coil as Q1 shuts off.

Since the 4060 counter (U2) is reset when the circuit is latched into its 'active' state, as detailed above, U2's timing sequence will restart with all of its outputs low. Ignoring the Q3 and Q7 outputs for the moment, you can see that main latch U3a will stay in a set state until its reset line (pin 4) is pulled high by one of U2's high-order outputs (Q11, 12 or 13) via R12 and jumper link JPA.

If JPA passes U2's Q11 output, for example (as shown in the schematic), U3a will be reset after 2048 clock pulses, or in real terms, after 2048 x 0.1 seconds or about 3.4 minutes have elapsed. Note that incoming audio signals *reset* U2 and effectively force the time delay to restart, so the circuit will only reset U3a after 3.4 minutes of signal inactivity. A continuous input signal will hold the timer continuously reset, as you'd expect.

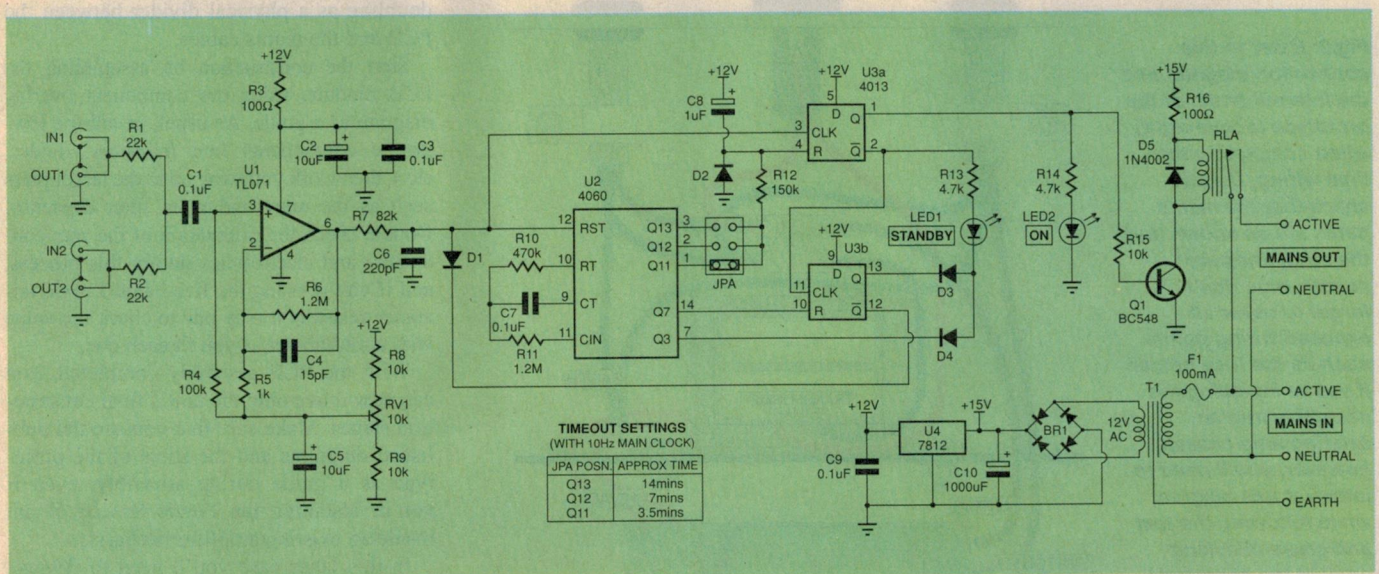


Fig.1: The circuit is quite straightforward and uses common, low-cost parts. Preamp U1 detects audio signals from the master unit, then triggers the timeout circuit based on U2 and U3 - this in turn activates the mains output via RLA, while U3b provides the signal 'lockout' feature.

Signal Controlled Mains Power Switch

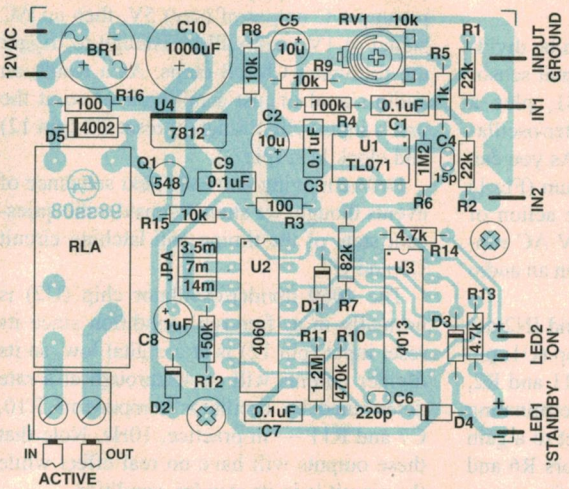
When the circuit does eventually 'time out' though, U3a's Q output shuts off RLA via Q1, while the rising edge at its Q-bar output (pin 2) clocks the remaining latch U3b (pin 11). This instigates the circuit's 'lockout' period, which eliminates the possibility of cyclic power-on events triggered by turn-on transients at the signal source.

With U3b now latched, the low level at its Q-bar output clamps the circuit's main trigger signal to a low level, via diode D1 and isolating resistor R7. For this lockout period then, the main latch (U3a) can't be triggered and the timer circuit (U2) is held active.

Also, the high level at U3b's Q output (pin 13) reverse biases D3, which allows the current through LED1 to pass to ground via D4 and the Q3 output of U2 (pin 7). As this output is cycling at around 1Hz, the standby indicator will flash at this rate for the lockout period — note that U3a's Q-bar output is now high, as during the standy state.

After a further delay of around 12 seconds (128 clocks), the lockout cycle is terminated as U2's Q7 output goes high, which resets lockout latch U3b (pin 10). The circuit then returns to its standby state — waiting for an audio signal at its inputs — with LED1 now continuously on via D3 and U3b's Q output.

The final section of the circuit involves the power supply, which is based on a standard 2851-type power transformer, T1. Here, its (nominally) 12.6V AC secondary voltage is full-wave rectified by diode bridge BR1 and smoothed by reservoir capacitor C10. The resulting 'raw' 15V DC rail is converted to a stable +12V supply by the 7812 three-terminal regulator U4, while C9 bypasses U4's output at high frequencies.



Left: The component overlay diagram for the PCB assembly - follow this closely during construction.

Right: An aluminium plate (or section of PCB laminate) is used to support the power transformer and divide the box interior. Note that the controller's PCB is mounted directly to the bottom of the case (right-hand section), while short sections of wire are used to connect the RCA input sockets to the board.

Construction

THE SIGNAL Power Switch unit is quite easy to put together, with the only demanding part being organizing the case construction (if you're not assembling a kit), and completing the mains wiring. The 240V mains connections are quite straightforward, of course; it's just that as with other projects which actively switch the mains, you need to carefully double check the accuracy and safety of your 240V wiring.

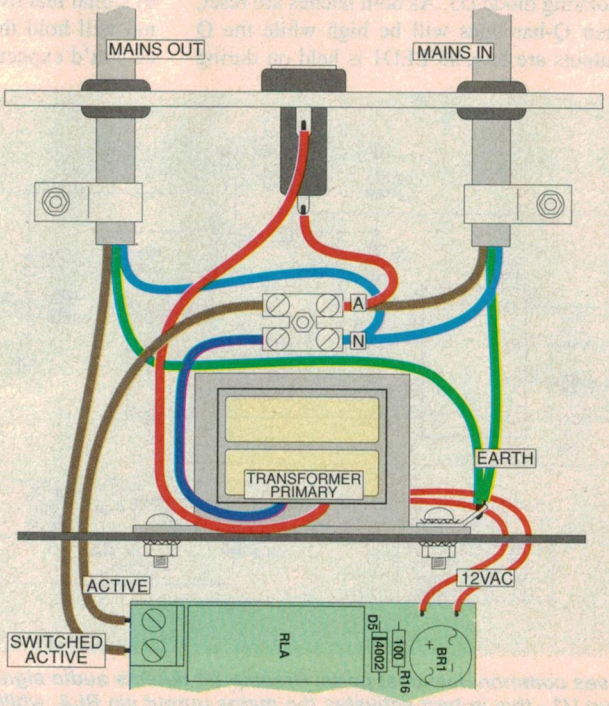


Fig.2: Refer to this connection diagram and the internal shots of the prototype (above right) when completing the final wiring. Double check that the mains paths are as shown and the earth lines are secure, plus don't forget to cover all exposed wiring points such as the fuse holder. If you're installing the assembly into an existing amp chassis however, you'll need to interpret this diagram while following the text and cross-checking against the schematic shown in Fig.1.

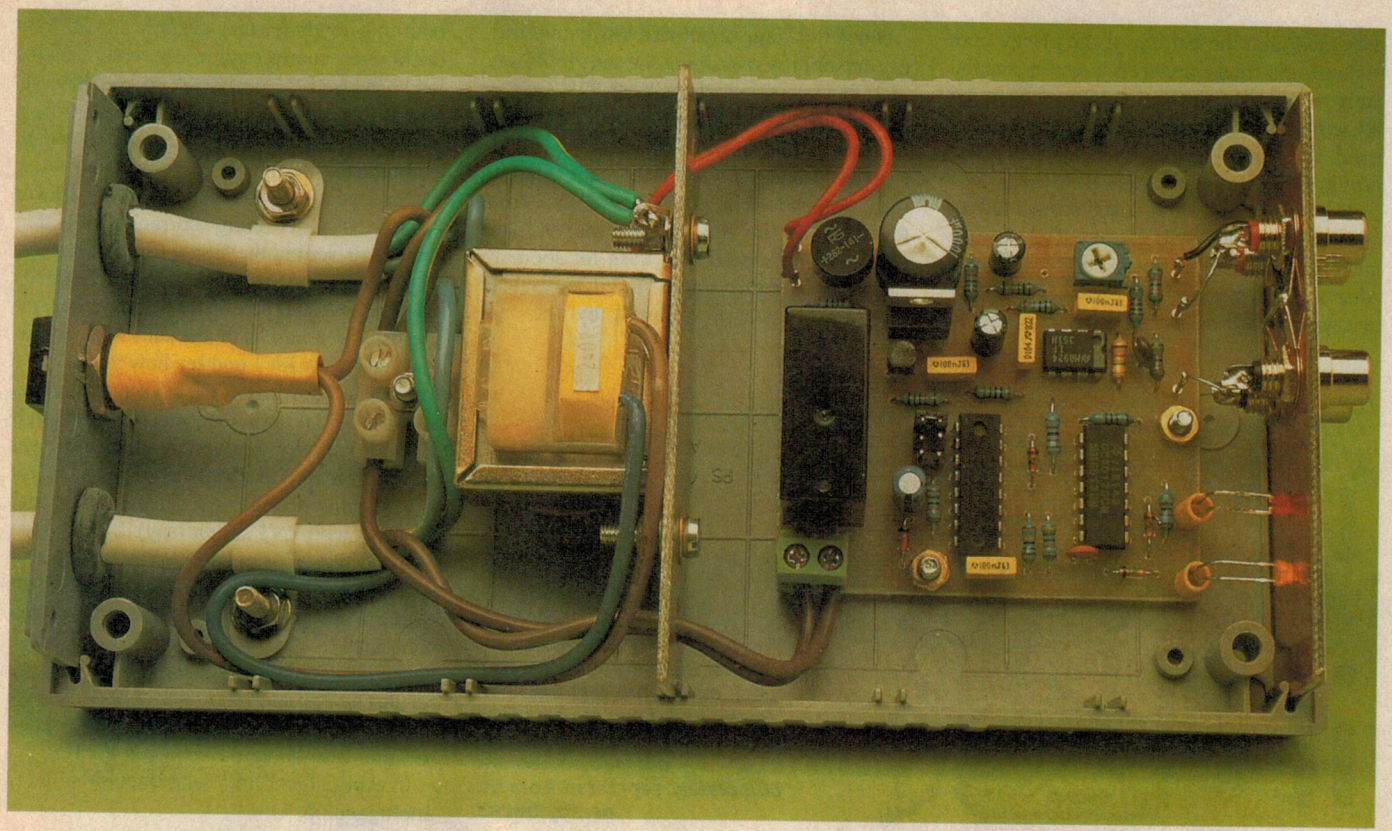
As you can see from the shots of our prototype, we used a common 190 x 100 x 40mm plastic instrument case to house the Power Switch, as this gives the unit a fairly neat appearance and a small frontal area. A number of other styles of plastic case would do the job just as well, and as mentioned, the circuitry could even be housed inside an existing amplifier. Regardless of how you house the circuitry though, you need to take care when wiring up and insulating the mains connections.

With our box arrangement the power transformer has been bolted to a mounting plate, which was then installed vertically in the centre of the case. The transformer is too high to be installed in a more conventional vertical fashion, and this setup solves the problem while providing an earthing plate doubling as a physical divider between the PCB and the mains cables.

Start the construction by assembling the PCB module, using the component overlay diagram as a guide. As usual, install the low-profile components first (resistors, diodes, etc.), then work your way up to the larger parts such as the relay and main filter capacitor. Double check the orientation of the semiconductors and electrolytics during this process, and if you're using the five-banded close tolerance resistors it may pay to check the value with a multimeter as you fit each one.

With the PCB assembly completed, you can now move onto the unit's final construction stages. Make sure that you use the published diagrams and the shots of the prototype as a guide during assembly, even if you're installing the Power Switch circuit inside an existing amplifier's chassis.

In this latter case you'll need to connect one of the circuit's audio inputs to the amp's signal input socket — or at some other convenient point in the signal path — using a



length of shielded cable. Other than that, an insulating layer should be installed between the PCB assembly and amp's metal chassis, and the amp's 240V wiring modified so that the Power Switch circuit's active in/out connections switch mains power to the amp.

If you're building up the unit in its own case though, you'll need mains in/out leads and audio input sockets just like our prototype. As you can see from its internal shots, the PCB assembly is bolted directly to the bottom of the case while the RCA input sockets are connected to the board via short wire links. Note that the input socket pairs are connected in parallel, to provide the signal link facility.

The mains wiring should be completed as shown in Fig.2, and the same basic connections made if the unit is installed in an existing amplifier chassis. Note that the fuseholder is not strictly necessary if the power transformer has an internal primary fuse, so in that case its active lead can be wired directly to the incoming active at the mains input lead — that is, connection 'A' on the two-way terminal strip.

By the way, we found that the neatest (and probably cheapest) way to build up the mains in/out leads is to sacrifice a short mains extension cable. Simply cut the cable at a suitable point, then bare back the ends to the correct lengths for the Power Switch's mains wiring.

Other points of note when completing the mains wiring are that the transformer earth solder lug should be fitted to the mounting bolt with suitable lock or 'star' washers, the access holes through the transformer plate should be 'de-burred' or even have protective rubber grommets, while all active and neutral mains connections must be covered or well insulated with sleeving.

PARTS LIST

Resistors

R1,2	22k
R3,16	100 ohms
R4	100k
R5	1k
R6,11	1.2M
R7	82k
R8,9,15	10k
R10	470k
R12	150k
R13,14	4.7k
RV1	10k horizontal trimpot

Capacitors

C1,3,7,9	0.1uF MKT
C2,5	10uF 16V electro
C4	15pF ceramic
C6	220pF ceramic
C8	1uF 16V electro
C10	1000uF 25V electro

Semiconductors

U1	LF351 or TL071 op-amp
U2	4060 CMOS counter with clock
U3	4013 CMOS dual D flipflop
U4	7812 +12V three-terminal regulator
Q1	BC548 NPN transistor
D1,2,3,4	1N914 diodes
D5	1N4002 power diode
BR1	W04-type 1A diode bridge
LED1,2	3mm LEDs, yellow and red

Miscellaneous

T1	12.6V/150mA power transformer (2851-type)
RLA	SPDT 10A relay, 12V coil
F1	small fuse holder with 100mA fuse

Plastic instrument case, 180 x 100 x 40mm; PCB coded 98ss08, 57 x 64mm; panel mount RCA sockets, 2 black and 2 red; 0.1" header strip, 3-way with jumper link; PC-mount terminal block, 2-way; mains-rated terminal strip, 2-way; short mains extension cable; cable grommets and P-clamps; earth lug; PCB pins; nuts, bolts and lock washers; mains-rated hookup wire; protective sleeving for fuse holder; transformer mounting plate, approx 90 x 30mm.

Checkout and setup

WITH THE UNIT now completed, fit the jumper link to the 3.5-minute position (nearest pin 1 on the 4060), rotate the trigger sensitivity trimpot RV1 fully counter-clockwise, then apply mains power to the unit. At this point, the standby LED should turn on or begin to flash, and there should be no activity from the relay. If not, quickly unplug the mains lead and double check your work — particularly the mains wiring.

Note that you need to take care when making any voltage checks or adjustments on the unit, since there are 240V AC levels around the relay section of the PCB. As the board is

mounted onto the bottom of the plastic case though, the tracks are well covered and the only 'exposed' point is the screws inside the PCB-mount connector. These can be covered with stout insulating tape during the testing and setup phase.

If all's well, use an insulated screwdriver or adjustment tool to slowly advance RV1's setting until the 'on' LED activates. At this point you also should hear a small click as the relay engages, while the standby LED should turn off.

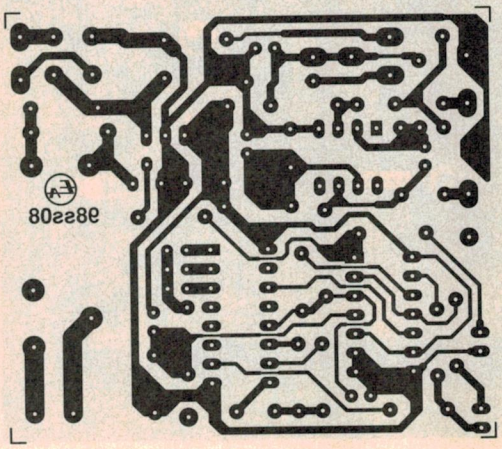
Since this adjustment will artificially trigger the unit (by overdoing the sensitivity setting) the next step is to back off RV1, so that the unit can 'timeout' and return to its standby state via the 'lockout' condition.

After around 3.5 minutes have elapsed then, you should be greeted by a click from the relay as the 'on' LED turns off. The standby LED should then flash for about 12 seconds while the trigger circuit is disabled (the lockout state), followed by the unit returning to its normal standby mode. You could even connect some convenient mains load (say, a desk lamp) to the unit's 240V AC output during these tests, as this will give a visual indication that the switched mains path is completed when the unit trips.

Once you've established that the Power Switch is functioning correctly, all that remains is setting the signal trigger sensitivity to suit your setup. As line-level signals are relatively standard in audio gear, the simplest solution here is to just start with a nominal setting for RV1 and see how you go. We found that adjusting RV1 for a preamp bias level of 5V DC provided more than enough signal sensitivity for typical audio gear, yet didn't promote false triggering.

In practice though, we'd recommend that you start with RV1 set for (say) 4V DC, then wind up the adjustment if needed. Note that adjusting RV1 for a given DC level is difficult with the unit's audio inputs shorted, or even connected to a signal source. This is because the input coupling capacitor C1 will charge (or discharge) into the input load as the bias level changes, which then causes the voltage to lag or over-shoot the setting at RV1.

In short, adjust RV1 with the unit's inputs unplugged. ❖



The actual-size artwork for the unit's PCB. If you make your own, make sure that the short tracks that carry mains power to the relay (lower-left corner) are well etched and completely separated from the nearby tracks.

Experimenting with Electronics

by Daren Yates, B.Sc.

Voltage Converters — 2

This month, in our last look at voltage converters for the time being, we look at circuits using inductors to create step-up and step-down converters.

Last time, we looked at how we could use diodes to create a circuit element called a charge pump, to boost voltages in the positive and negative directions.

While a diode charge pump does work fairly well, it's by no means the most efficient way of doing things. We're now going to move into an area that has exploded in prominence in electronics circles over the last 20 years or so, and that's the area of switching power supplies.

If you've had a look recently at the power supplies that come with the average, standard notebook computer, you would have seen that they can handle an input voltage of anywhere between 100 and 270V AC and still deliver the same output voltage — somewhere near 20V DC at about two amps.

Now in the past, this would have required a device called a variac and a large transformer. The whole kit would have been almost as large as a standard desktop PC case.

That's where switching power supplies come to the rescue. Using switching technology, power supply designers have managed to do away with the transformer and shrink everything down into a box the size of a couple of matchboxes.

Simple does it

Now I don't propose to show you how to create a power supply the size of a matchbox to power your washing machine, but these circuits will at least show you the basic theory behind them. They also have some useful applications.

OK. Let's start off with a really simple transistor circuit. Looking at Fig.1, the most important thing to notice straight-off is that the power supply is limited to 3V. Please note this — you'll find out why in just a minute.

The circuit itself can be divided into two sections: the first being the two-transistor oscillator and the second being the switching network.

The oscillator is running at about 2kHz, although the frequency is not overly critical — provided you're somewhere between 1kHz and 10kHz, that should be fine. The thing to notice is the output pulse from the collector of transistor Q2 is a narrow positive-going pulse.

The fun really happens in the second or switching stage. That narrow positive pulse from Q2 is fed to the base of Q3. Now the circuitry around transistor Q3 can look a bit scary, but we'll take it easily...

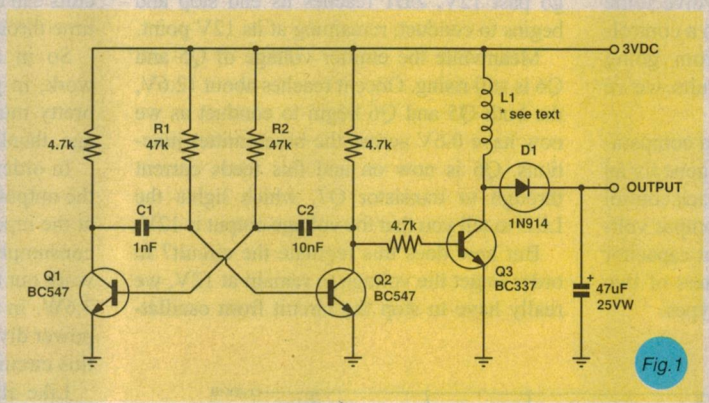


Fig.1

An inductor?

This is where things get a bit 'do it yourself'. Making an inductor, particularly for this circuit is pretty easy. All you need to do is to wind about 60 turns of 22SWG-gauge enameled copper wire (ECW) around a 50mm piece of ferrite rod — the same stuff used in radio antenna coils. The only trick to winding such coils is to keep the turns close together and neat.

Alternatively, you can use what's known as a iron-powder toroidal core. This is basically a ferrite core that looks like a 'Lifesaver' on steroids, or a slightly shrunken doughnut. Look for one with an outer diameter of about 15mm. You can pick one up for about $3 from your favourite component shop.

Just wind one layer of turns around the core — in through the centre then out and around the outer side and back in again — and then a second, until you have completed two layers. Don't worry too much if it isn't perfectly neat. Just do the best you can.

Cut the two ends of the wire back to a reasonable length, then scrape off the enamel from two ends and you've got yourself a very nice inductor. You can use it for all of the circuits in this month's column.

Now back to our circuit. We've got the inductor connected to the collector of transistor Q3, with the emitter going to ground.

Normally, you could be excused for freaking out at this stage, and expect to see wisps of blue smoke rising from the smoldering ashes that used to be Q3. But the circuit relies on the narrow positive pulses fed to the base of Q3 to prevent this from occurring.

What happens is that Q3 is only on momentarily — but enough to allow the inductor to charge. Energy is stored as current flows through a inductor. Once that current stops, the inductor tries to maintain that energy by raising its voltage. It's similar to what we saw last month, where a capacitor can't instantly change its voltage when one voltage end is shifted.

In this case since the power supply end of the inductor is a fixed voltage, it's the collector side that rises. In our case, it can rise to upwards of 15V — from just a three volt supply. If the supply voltage was six volts, it could rise to above 30V and possibly snuff the transistor for you...

An ordinary signal diode is used to siphon off this voltage and fill a reservoir capacitor. Once the voltage from the inductor is dissipated, the diode is no longer forward-biased and the charge remains stored in the capacitor.

Now obviously, one pulse isn't going to do much. But when you get 2000 of them per second, it is possible to draw quite reasonable amounts of current. But not from this circuit.

If you connect your multimeter up to the capacitor, you should see a voltage in excess of 12V.

Converter No.2

The last circuit was definitely crude and lacked protection for the components of any sort. This next circuit can be used to run small 12V devices and projects from a 6V power source.

You should see some similarity between this and the last circuit, with one addition — and that's the regulating circuitry.

As before Q1 and Q2 form a pulse oscillator, feeding driver transistor Q3. Switching transistor Q4 is now a BD681 darlington-type power transistor. The tiny BC337 we used before would curl up and die in this circuit. However, the BD681 shouldn't need a heatsink — again, I'll get to that in a minute.

The ordinary signal diode we used in the previous circuit would also blow in a hurry, so this circuit uses a special power diode known as a *fast-recovery* diode. It's designed specifically for this purpose and can handle up to seven amps of current, although we won't be getting anywhere near that figure.

If we want this circuit to produce 12V DC, we need some way of controlling it and we do so, using negative feedback.

You should be starting to see a pattern in many of the circuits we've looked at here in the last couple of years. Most involve some input or output manipulation, with a controlling circuit to prevent them from going berserk. Many of the audio circuits we've looked at are a case in point.

Rather than cheating and using a comparator to make the job easy, here, I've gone for an all-transistor approach to the feedback control circuit. We take a sample of the output voltage from directly across the output capacitor and this is connected to the emitters of two transistors Q5 and Q6, both PNP types.

The base of Q6 has a 2.2kΩ resistor and a 12V zener diode connected to it. This is the basis of the controlling circuitry.

A zener diode is another component we haven't used here often. Basically, it's a diode that exhibits the same properties as an ordinary diode when forward-biased, i.e. it allows current to flow in one direction with a forward voltage drop of about 0.6V.

But this diode also has what's known as a 'zener voltage'. While ever the voltage across it in the reverse direction is less than this zener voltage, no current can pass. But once its zener voltage is reached, it allows current to flow quite easily.

The trick though is that its voltage drop in this reverse conducting mode remains relatively constant. By the way this mix of voltage and current makes these diodes fragile and easy to blow up if you're not careful. But since we're only using the zener here as a control element, we don't need lots of current and one of the standard 400mW types is perfect.

Getting back to the circuit, while the voltage at the output is below 12V, the base and emitter of Q5 and Q6 remain at the same voltage, because zener diode ZD1 hasn't started to conduct current yet. But when the output tries to go past 12V, ZD1 reaches its end stop and begins to conduct, remaining at its 12V point.

Meanwhile the emitter voltage of Q5 and Q6 is still rising. Once it reaches about 12.6V, the both Q5 and Q6 begin to conduct as we now have 0.6V across the base-emitter junctions. Q6 is now on and this feeds current through to transistor Q7, which lights the LED to tell you that the voltage output is 12V.

But how does this regulate the circuit? In order to get the voltage to remain at 12V, we really have to stop the circuit from oscillating, or at least stop the switching part of the circuit from operating. With no charge pulses coming from the inductor, the voltage across the capacitor will drop quickly as current is taken from it by the device it is powering.

When the output reaches 12.6V, transistor Q5 also conducts — pulling the base of the driver transistor Q3 high to 12V. This ensures that transistor Q3 turns off and stops Q4 from switching.

Note diode D1. Its job is to protect Q3 from being zapped by pulling the base too far above the emitter.

Once the voltage at the output drops, transistors Q5 and Q6 stop conducting, allowing the switching part of the circuit to operate again and charge up the reservoir capacitor once more, until it tries to go past 12V and then the whole thing swings full-circle.

I like this circuit because it doesn't rely on any ICs. In fact, all but the power transistor are standard common-variety transistors that we've been using for the last few years in this column.

You shouldn't have any trouble finding any of these components from your local electronics supply store.

If you didn't quite follow all of that, just read through it again. These 'circular' circuits can be pretty difficult to master the first time through.

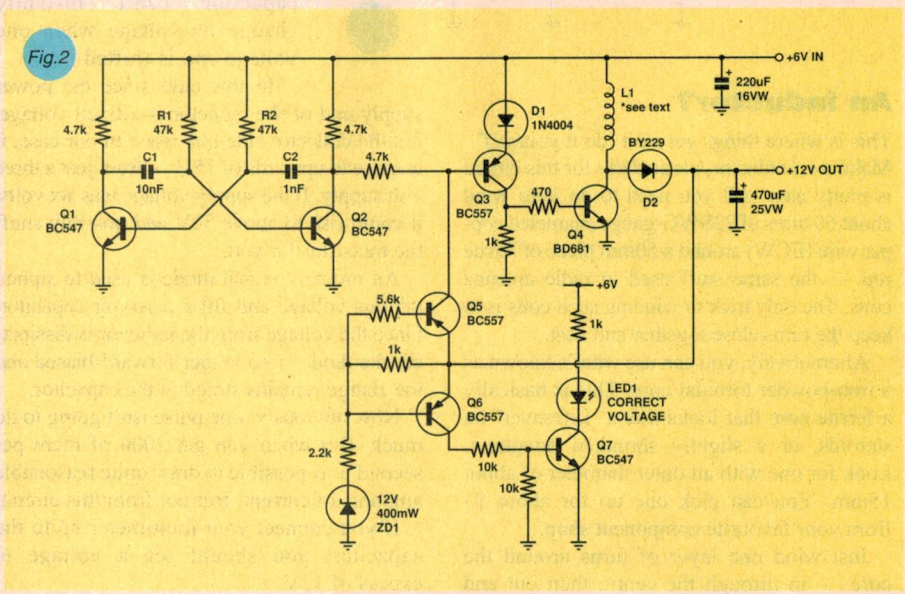
So in a nutshell, how does this circuit work, in producing 12V from 6V? Well, it pretty much just converts current into voltage, thanks to the inductor.

In order to get 12V at about 300mA from the output, you'll need 6V and about 900mA at the input. If you work out the input power consumption, it's about 5.4W. And if you work out the output power delivery, it's only 3.6W. In terms of efficiency, that is, output power divided by the input power, you'd say this circuit is 66% efficient.

Like all circuits, this one chews up some of the power doing its job. The less power it uses, the better the design because the more it can deliver to the output.

I mentioned before about heatsinking. At output currents of about 300mA, you'll find that the transistor and fast-recovery diode will get a bit warm. To ensure their long-term survival, I'd recommend you add a couple of mini heatsinks. You can get these for less than $1 each and they simply screw in place, with the flat surface of the heatsink up against the exposed metal area of the transistor or diode.

Most of you will have figured out by now that by changing the zener diode, you can change the output voltage. So a 15V diode will give you a 15V output, etc. Just remember that the higher in output voltage you go, the more current you'll use from your supply source.



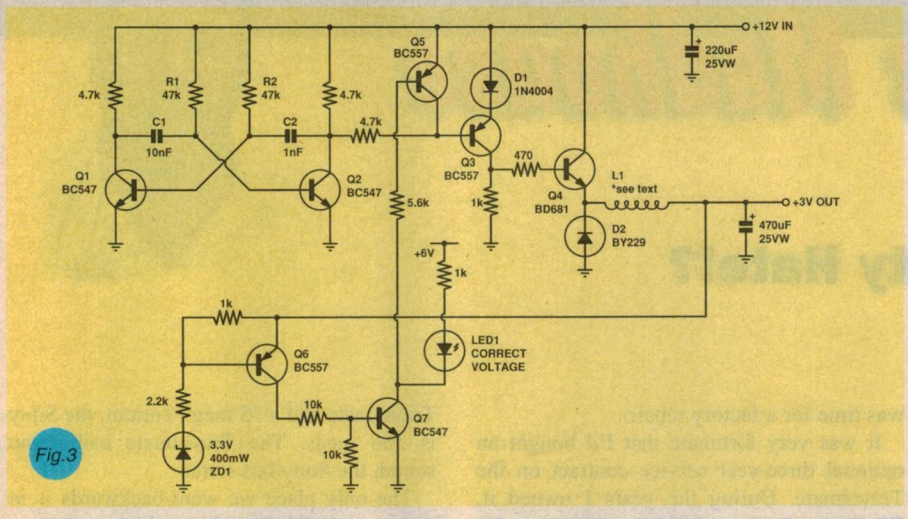


Fig.3

Converter No.3

Our next circuit will allow you to operate your personal stereo or CD player from the cigarette lighter in your car. More precisely, it converts the 12V DC from the cigarette lighter down to a 3V source for your stereo.

Now there will be some people who'll say why not just use a three-terminal regulator with a heatsink, and be done with it? But if the personal stereo requires about 150mA to run, a three-terminal regulator is still going to need 150mA to run it. In contrast this circuit will only need about 60mA.

Looking at the circuit in Fig.3, you'll see that there's not a great deal different to the last circuit. The previous circuit is known as a 'step-up converter'. This one is a 'step-down converter', also known as a 'buck' converter. It's a little more complicated due to a necessary change in the regulatory circuitry, but it still follows the same principles as before.

The oscillator is left unchanged and it feeds the driver transistor Q3 as before, which in turn drives the switching transistor Q4. However this time Q4 controls the inductor in reverse.

When Q4 is on, the inductor charges. But when Q4 turns off, one end of the inductor feeds the reservoir capacitor while the other end remains connected to the emitter of Q4. The fast recovery diode now works to prevent this end of the inductor going further than -0.6V, so that the energy is dumped into the capacitor. (In the last circuit, one end of the inductor was tied to the supply rail.)

The diode here also acts to protect the switching transistor from copping too large a voltage across its collector and emitter.

Now to make sure the output voltage stays at or about 3V, I've had to change the regulating circuit slightly. The output voltage feeds back to the emitter of Q6 as before. It remains switched off until the output voltage rises above 3V. Once this happens, ZD1 conducts, Q6 turns on, turning NPN transistor Q7 on and the LED is lit to indicate that the voltage is correct.

The change is that it's now Q7 that drives transistor Q5. Note how it is connected, between the base of Q3 and the supply rail. When the output hits about 3.3V, Q5 turns on, pulling the base of Q3 just above its emitter voltage and shutting both it and the switching circuitry down.

With no current feeding it, the capacitor soon loses its charge, the voltage drops and the circuit starts up again.

Because it's a step-down circuit, you can pull more current from the output before you'll need to worry about heat sinking.

This circuit will easily supply enough current to run a personal stereo. And as before, you can adjust the output voltage by simply changing the value of the zener diode. The only thing to remember is don't go any further than 12V, or else the whole thing is a waste of time!

If you do intend to use this converter with audio circuitry, you'll need to do a couple of things.

First, I'd put the whole project inside a diecast box to keep all the nasty radio frequencies inside. I'd also add more filtering to the output. Even though the capacitor does do some filtering, the DC voltage at the output will still have quite a bit of the switching frequency present. A couple of 0.1uF capacitors at the output will help to shunt away the noise and keep the supply quiet.

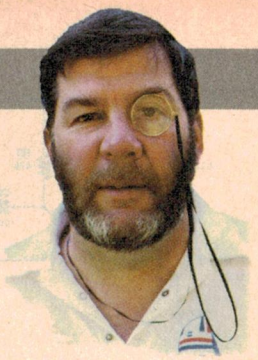
Check that the output voltage is correct before you connect it up to any voltage-sensitive circuitry.

Switching circuits have become so popular that there are now a number of ICs dedicated to doing just as this circuit does, but with greater ease and better efficiency. Texas Instruments' TL496 is a tiny chip that will convert 1.5V to 9V using basically the same techniques I've used here. Philips also has a chip, the TEA1100 that uses switching techniques to charge up NiCad and NiMH batteries.

I have no objections to these chips and in fact, I've used them in projects a few years ago myself. But as I've said before, you can't learn about circuit techniques by just hooking up a chip.

OK. That's all for this month. We'll look at some more circuits to experiment with next time. See you then. ❖

Moffat's Madhouse



Windoze Mighty Hate!?

ALL TOGETHER now — how many of you have upgraded to Windows 98? How many have done it voluntarily? How many have had no choice? I'll bet many upgrades were forced, like mine.

I've been a Windows 95 user for a couple of years now. I was reluctant at first — I'd developed a working relationship with Windows 3.1, although my preference had always been (and still is in many ways) MS-DOS. But then I took a job doing tech support with an Internet Service Provider, and that meant learning Windows 95. Which in turn meant getting a new computer, since my old Windows 3.1 machine with its 486 processor and 8 megs of RAM would never handle Win95 in a fit.

That new computer turned out to be a Texas Instruments Travelmate 5000 laptop; you've probably heard me talk about it before. It was a fine machine and I loved using it. It had a great screen and probably the best keyboard in the business. But the first few months I had it, the Travelmate sometimes threw tantrums and crashed. I decided it might have something to do with some software of dubious quality that had worked its way into the machine.

So I finally decided to reformat the hard disk, breaking it up into three partitions — C:, D:, and E: — of varying capacities to make most efficient use of file allocation table sizes. This left the C: drive exclusively for the use of Windows and DOS, with the enormous Windows application programs installed cleanly in the D: drive. Drive E: was where I stored stuff like my magazine article archives and old tax records.

From then on, the Travelmate behaved itself perfectly, at least in the software sense. But something was slowly going wrong with the machine itself, mostly in the power supply area. It ran hotter and hotter, eventually getting so hot that floppy disks left in the drive were almost too hot to handle. Some even warped. Later other heat-related effects began appearing; sometimes the machine would not boot at all when it was hot. So it was time for a factory repair.

It was very fortunate that I'd bought an optional three-year service contract on the Travelmate. During the years I owned it, TI's laptop business had been taken over by Acer, and by the time mine went bung the company no longer stocked parts for it. Unrepairable — I had a two year old orphan.

But the service contract stated that if the computer became unrepairable, it would be replaced by a new one. After some half-hearted attempts to worm their way out of it, the dealers finally coughed up a brand new Sony Vaio notebook computer. With Windows 98: compulsory, no choice.

(It's interesting that many big US retailers are no longer dealing with the likes of Texas Instruments or Winbook or Micron or Compaq. Or Acer. Instead they flog computers made by Japanese consumer electronics manufacturers — my retailer offered a choice of Sony or Fujitsu laptops, and that was all.)

I've always had a soft spot for Sony stuff, after years of experience with things like Sony tape recorders and shortwave radios. Never once a dud; most of it's still working years later. And there's all that Sony broadcast video equipment I've worked with. So Sony got my nod, although a fellow I work with has a Fujitsu laptop and he loves it too.

It's interesting to see how things have changed in two years, and I think the demise of my Travelmate may have been a blessing in disguise. The Travelmate had an 800 meg hard drive; the Sony has 2.1 gigabytes. The Travelmate had 8 megs of RAM (I upgraded it to 16); the Sony has 64 megs. The Travelmate had a 75 meg Pentium, the Sony is 266 megs. The Travelmate had mono sound, the Sony has stereo.

The only place we went backwards is in the screen; the Travelmate had an active-matrix LCD, the Sony has DSTN — although a very nice one, somewhat larger than the Travelmate's. The keyboard isn't quite as nice as the Travelmate's, but the pointing device is much better. All in all, I think I came out the winner.

But — I'm also a somewhat surprised and unwilling user of Windows 98. You've all heard me whinge about Windows in general, and Windows 98 in particular, mostly because of unnecessary size and bloating, and the compulsory inclusion of the Microsoft Internet Explorer web browser. (A full upgrade/install of Win98 can take 300MB of hard disk space.) And now, I am sitting here typing on my nice Sony laptop, while Internet Exploder lurks within, waiting for just the right moment to wreak revenge for my incessant Microsoft bashing...

When I first turned on the computer, I told myself I'm going to view it as any new user, let it do its stuff (more or less) and try my hardest to love Windows 98. But I did take certain precautions...

All right, I'm going to give the damn thing a chance. When I first turned on the computer, I told myself I'm going to view it as any new user, let it do its stuff (more or less) and try my hardest to love Windows 98. But I did take certain precautions...

The 2.1GB hard drive arrived from the factory almost half-full of various programs, trials, and temptations. Many would never be used, and could be dispensed with. For instance, there was an array of things you could click on to sign up for free time on America Online, Compuserve, the Microsoft Network, and several others. It took only a few minutes to heave them out of the computer, using the same techniques I've used in Windows 95.

Win98 is very similar to Win95 in many ways. The biggest feature of Win98 is the way it integrates with the Microsoft Internet Explorer web browser so that the Internet becomes part of Windows 98's everyday life. This integration is also a characteristic of later versions of Windows 95, and was the subject of a furious court battle in the USA.

Microsoft claimed that Win95 that came with MSIE installed, wouldn't run without it. But that turned out not to be the case at all, as pointed out in recent Madhouse columns. It proved possible to hack MSIE out of Win95, and later on an 'add/remove programs' option became available, most likely in response to the court action.

Now MSIE is bound into Windows 98 tighter than ever, and if you believe what you read in the technical press here in the USA, MSIE is truly uninstallable. And it is firmly in control.

Windows 95 gave you the option of declaring your favourite browser such as Netscape or Opera to be the 'default browser'. So if you clicked on an Internet address sent to you in an e-mail message, Windows started your chosen browser to show the web site. Now, MSIE does the job whether you like it or not.

You *are* allowed to install and use other browsers. The Sony computer came with Netscape Communicator as part of its supplied software, and I've installed Opera as well. Both of them run just fine under Win98, but so far I've found no way at all to convince my Eudora e-mail program to call up Opera when somebody sends me the address of a web site full of jokes. It's a pity; Opera is *soooo* fast to respond. MSIE is fairly fast too, but that's because it is already running any time Win98 is running. MSIE is loaded every time Windows starts, which makes startup soooo slow. Quite infuriating...

There are some new features in Win98 that allow it to do all kinds of fancy hardware tricks. For instance, a USB (Universal Serial Bus) port that actually works with Plug and Pray. I read about someone who plugged a new scanner into the USB port, and Win95 recognized it, asked for the Windows CD-ROM to load some drivers, and that was that. Scanner working. The same thing happened when I plugged my Hayes modem card into a PCMCIA port on the Sony. It recognised and installed the modem immediately, even though the Sony already has an internal modem of its own.

Win98 even offers support for DVD drives (lots written about DVD in *Electronics Australia* lately). In my ignorance I thought that meant I could simply plug a DVD disk into the Sony's CD-ROM drive and it would play, just like a music CD does. But no, you have to have a special external drive.

There's been a radio commercial running in the USA ever since Win98's release. A girl phones her boyfriend to rave about the Win98 upgrade she's just bought for her computer. "You can even show DVD movies", she says. And he says "Who wants to watch movies on a computer screen?". And she says (insultedly) "Sounds like you need a new girlfriend. Goodbye." So he goes out and buys Win98 too. Just like shaving lotion: Buy Win98, get (or keep) the girl...

Another Win98 feature lets you run several video displays from the one computer. You can have up to eight of them, and apparently it's possible to scoot the mouse along and it will jump from one screen to the next. So you can have one program running in each screen, and jump back and forth among them. One article I read suggested that you install one of those TV tuner cards in your computer, so you could watch Oprah Winfrey on one of your screens as you work. It seems to me you could accomplish the very same thing with a cheap portable telly sitting there next you your computer. There are hard ways, and easy ways, of doing things.

Although Win98 really does seem at first to be little more than an upgrade of Win95, there are some wonderful techie innovations. The one I like best is the way it implements a disk cache. Win95 used the SmartDrive method which stored a copy of every file the computer accessed in a special cache area of memory. Then, if the file was needed again, the copy was used instead of loading a fresh one from the hard disk. Result: more speed, less disk spinning.

Win98 does this by simply storing a software pointer to the original file, rather than storing a copy, and keeping the original file intact as long as possible. So instead of having two copies of a file, the running copy and the cached copy, the computer's memory only contains one copy of each recently accessed file. So only half the memory is needed.

Another interesting feature is Win98's System Info utility. This thing actually peeks into the registry and displays every pertinent registry entry for a particular item such as a modem. Much of this of course is strings of hexadecimal digits, but if you're trying to troubleshoot something big-time, this is often the stuff you need. You can of course drag it out line by line using the RegEdit program, but System Info gathers it all in one convenient pile for you.

So, as I said, I'm giving Windows 98 a fair trial. But sometimes it is very hard to be fair. Since day one, Windows 98 has been crashing regularly in my new Sony — usually on exit. This means data is almost always safely saved before the crash takes place. But when it does crash, Win98 delivers the familiar 'blue screen of death' with a message saying Press Any Key to Continue.

Of course it won't continue, because the keyboard no longer works. The only way to get rid of the blue screen of death is to power-down the computer. The Sony doesn't have a proper power switch or reset button, only a 'soft-switch'. So you must disconnect the mains cord, then open the little door, then remove the battery, then count to ten, then put it all back together again. This is really quite intolerable...

I think back to my old Travelmate, and how simple everything was. And I think of this new Sony, and how it's trying so hard to be a nice computer, but it's lumbering along under the weight of Windows 98 and its compulsory Microsoft Internet Explorer. I still own a CD-ROM with Windows 95, the latest OSR-2 version. I am so tempted to reformat the Sony's hard disk and set up the Sony just like I had my Travelmate!

At my current place of work (I seem to have fallen into a TV station again), we just ordered a nice new Dell computer for the office, and for graphics work. Dell gives you a choice: Windows 98, Windows 95 with MSIE, or Windows 95 WITHOUT Internet Exploder. So, the choice was made: Pure, plain Windows 95, which will then be joined by Netscape and Opera and Eudora and all the other software I know and trust.

In the meantime I'll keep Win98 running and try to figure out a solution to the crashes. While preparing this article, I told my new Sony that the next time it crashed, I was going to take a picture of its blue screen of death to show all the readers what a stupid computer it was. I guess it got the hint; it hasn't crashed since. Problems often have many solutions! ❖

Vintage Radio

The Year that Was: 1927

Many readers will be familiar with the *EA* publication The Best of Wireless Weekly in 1927, published way back in 1985 (and unfortunately now out of print). That publication gave a good idea of the state of radio affairs in 1927, but let's look at what is revealed from other issues of WW and its competitors.

IN THE FOREWORD and introduction of the abovementioned publication, the late Mr Neville Williams and current *EA* editor Jim Rowe both mentioned that 1927 was a milestone year for 'radio' because radio was emerging from the realm of the experimenter, the amateur and the entrepreneur, and was evolving into an organised 'big business'.

By 1927, the larger capital cities had three or more stations (Hobart being the exception) from which to choose a programme. Also, local radio dealers and manufacturers were offering ready-made sets, ready to simply take home, connect up, switch on and listen to the amazing tinny, sibilant and distorted sound emanating from a horn speaker, that passed as sheer wonderment!

There is probably no more graphic example of such an offer as the 'DJ Standard 4', offered at £25 less 10% for cash. This time, everything you actually needed was included in the purchase price — equivalent to five weeks' wages. The entire advertisement, which appeared in *Wireless Weekly* for February 11th, 1927 is reproduced in Fig.1 and is quite self explanatory. For those of a mathematical bent, all the information is there to work out the interest rates for the extended purchase plan!

Another economically priced set was the 'AJV' two-valve set, on offer from Arthur J. Veale of Melbourne, complete with a small Brown H4 horn speaker for the very reasonable price of £11/5/- ($11-50). It was advertised in *The Listener In* for July 21st, 1927 and is illustrated in Fig.2.

Readers may recall from my previous columns of 'The year that was...' that radios were sold at astonishing prices, and equal sums had to be outlaid for valves, batteries and a speaker. The comparison of buying a new car and being asked to pay extra for the engine, gearbox and tyres has been previously made.

£2/10/- Deposit and 9/6 per week buys for you

The "D.J. Standard 4"

£25 less 2/- in the £ for Cash

makes the cash price £22/10/- absolutely complete

This powerful and highly selective Set is simplified to the greatest possible extent, there are no moving coils to change or get out of order—only two dials, so simple that anyone can regulate the tuning. Once tuned in the "D.J. Standard 4" remains stable. There is no difficulty in picking up which ever station you want—and £22/10/- is the first and last cost while the Sale is on.

Here is what you get for your £25

4B406 Mullard PM3 4-volt, 33-amp. Peto-Radford Accumulator, 2 large capacity Winchester "B" Batteries, 1 Trimm Entertainer Speaker, 1 pair Trimm Dependable 'Phones, 2 'Phone Plugs, 100 feet of Aerial Wire, 30 feet of Insulated Lead-in Wire, 4 Insulators, 6 feet Flex Wire for connecting Batteries, 1 Lightning Arrester. The whole encased in handsome cabinet of polished maple.

Buy it on Deferred Payments

You can now have the pleasure of securing the "D.J. Standard 4" delivered into your own home on the deposit of £2/10/-; balance to be paid at the rate of 9/6 per week, to be completed within 12 months.

DAVID JONES' SALE

Less 2/- in the £ for Cash.

Fig.1: An advertisement which appeared in Wireless Weekly for 11/2/27, offering the 'DJ Standard 4' complete for 25 pounds, less 10% for cash or at 'generous deferred payments'.

Speaking of cars...

ALTHOUGH mention was made of automobile radio in this column about six months ago, we find an earlier reference to an automobile radio in *WW* for July 22nd 1927, and by heavens, what a contraption!

It would be nice to reproduce the entire page, but that is not possible. Briefly, the car, a 14hp Park Lane saloon, is equipped with a frame aerial, which must be fully three feet across, enclosed in celluloid (not cellulite), mounted somehow at the back of the front fender. The wireless itself is a fully contained nine valver, with — wait for this — 'concealed wiring', and the reproducer invisibly mounted in the roof. Would such a marvel be beyond the comprehension of the simple mind?

Loudspeakers

1927 ACTUALLY saw the introduction of the 'cone speaker', which marked the beginning of the transition from horns to the modern day low impedance speaker. As has been previously described on many occasions in this column and also in 'When I Think Back', the horn speaker is basically a very large headphone surmounted by a megaphone. Despite their rather unusual shapes, the megaphones were approximately exponential in shape for reasons of best available frequency response and greatest efficiency. The cone speaker was a euphemism for the balanced armature speaker. With these speakers, no matter which way they were connected, either one or the other of the armature magnets would tend to be de-magnetised by the direct current (DC) flowing through the speaker driver unit. Because of this, output transformers were provided in some of the manufactured sets; electric sets in particular.

The RCA model 100, Philips model PCJJ,

Brandes tablecone, Magnavox, Amplion and Sferavox were the popular makes making an appearance.

With the arrival of cone speakers, the horn variety were plummeting in price. Indeed, in *WW* for July 1st 1927 is an advertisement for a Trumusic Junior, 18" high and with adjustable driver unit, for the most reasonable price of 19/9d. Other speakers from the 'Amplion' and 'Brown' ranges were priced from £2/-/- ($4-00) onwards.

Valves

THERE SEEMS to have been no new valve releases of note for 1927, but prices were falling. The UX 171 and UX 112 were coming down in price to 25/-. Various dubious brands of bright emitters were priced from 5/6 onwards and the 201-A were available for 11/- to 12/-, while the UX 199 was available for about 12/6 to 13/6. The De Forest series of DV5 and DV3 were available for similar prices.

The Philips range of B406, A409, A415 and A425, and the less heard-of types A109 and B105, and also A 310 and A 306 were on offer, but no mention was found of their prices. The Mullard range, PM1 HF, PM1 LF, PM2, PM3, PM4 and PM5 were on offer, from the very reasonable price of 13/6 ($1.35)

Apart from the 171, there appears to be no mention of the new electric types 226 and 227 — although mention was made of imported American all electric sets, particularly later in the year, which would have used those types.

Interesting snippet

YOU CAN GLEAN a good idea of events in 1927 from the editorials in *Wireless Weekly*, and the page called 'The Safety Valve'. There are any number of issues raised by the readers, all largely concerned with programming content. Too much jazz, not enough jazz; too much classical, not enough classical; too many religious broadcasts, not enough religion; and so the list goes on.

One interesting snippet from the July 1st issue is the fact that the Grand Organ in the Sydney Town Hall was going to be broadcast over 2FC, played by the then city organist, Mr Ernest Truman. Probably not many readers have heard the Sydney Town Hall organ live. Compact discs and quality stereo amps of the modern era can do this organ justice, but this wouldn't have been easy at the time. It's an enormous pipe organ of immense power and complexity.

To attempt to broadcast such an instrument with the less than adequate microphones, very low performance audio transformers inside the radios and the even less responsive loudspeakers of the day was an ambitious and somewhat unrealistic undertaking.

Fig.2: The 'AJV' two-valve set, complete with batteries and speaker, for merely 11 pounds 5 shillings, as advertised in The Listener In for 21/7/27.

Uses of radio

AS WELL AS the early attempts at radio installations in motor cars referred to earlier, articles began appearing about the 'extended uses' of radio. For example an article appearing in *WW* for February 11th, 1927 begins: *This is an age of extensions — extended time payments, extension telephones, and now a method for extending the use of radio, having particularly in mind the use of the farmer and his wife who are deprived of some of the benefit of their radio set by reason of the fact that many of the worthwhile programs* (sic) *are broadcast just at a time when the evening jobs must be attended to outside...*

The article went on to explain how extension speakers could be placed — but 'best results are obtained with a five-valver with a power valve!'

Yet another feature article, which even commanded front page billing, extolled the use of radio to assist those in convalescence. (*WW* for 11th March, 1927). This is a most interesting commentary, more akin to the student of medical history rather than the student of radio history. For example, the caption under a photo of the Fairlight Private Hospital, Manly, says in part *where the writer was confined for some weeks suffering from a fractured jaw and lacerations and abrasions, as a result of a motor car accident*. One hopes the poor chap recovered, and one shudders to think about how long he might have been confined if there was something seriously wrong!

Interesting circuits

THE YEAR 1927 saw the introduction of reaction being controlled by a variable capacitor, rather than the variometer or variable coupling of coils. This became the circuit configuration used for one- and two-valvers to the end of the valve era. It was claimed to be the superior form or reaction control; a claim subsequently well justified. The one valver described in *WW* for 11th February describes 'A Throttle-Control One Valve Receiver'.

Why the choice of words 'Throttle-Control'? Perhaps it was a thickly veiled allusion to 'throttling' the meddlesome fools who couldn't keep their hands off the controls!

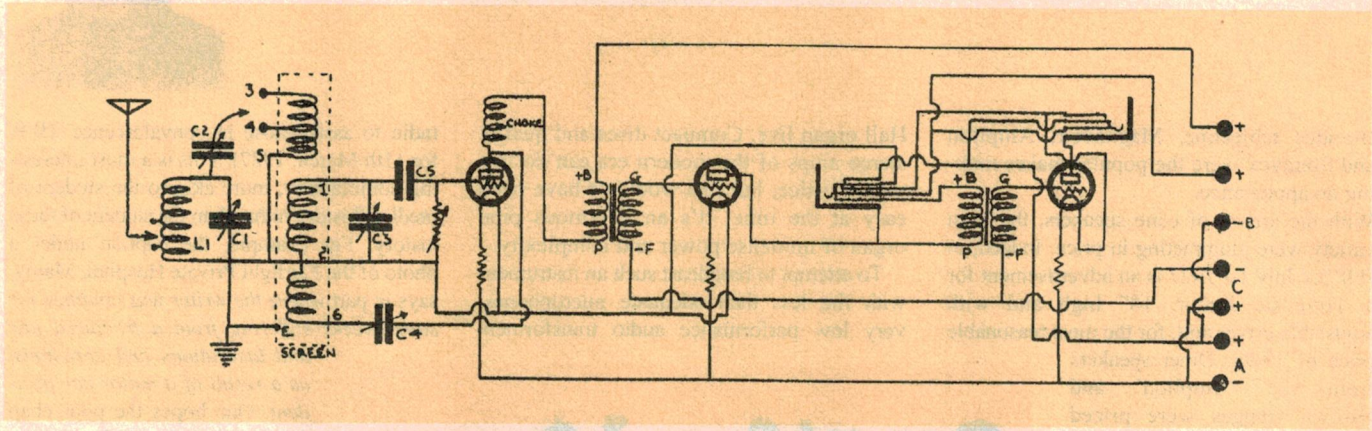


Fig.3: The 'Wave Trap Three' receiver described in WW for 18/2/27, and using a novel inbuilt wavetrap to reduce interference from nearby stations.

Actually, there were quite a few one valvers described in 1927. Whether these sets began the introduction of the second radio in the home, or were aimed more towards the reluctant constructor, is open to debate. With the new low-consumption valves and the new circuits, all manner of claims were made.

Reproduced in Figs.3 and 4 are two circuits which seemed to have had only a brief period of popularity. They both incorporate only three valves, and also the use of a wave trap to tune out any overpowering local station.

The circuit in Fig.3 (from *WW* for February 18) shows the antenna being coupled via a tap to the parallel tuned wavetrap C1/L1. This circuit is to tune out the unwanted station. The antenna is then virtually capacitively coupled via C2 to the best tapping on the primary of L2. At non-resonance, the impedance from antenna to C2 is merely the resistance of L1, which can be ignored. Notice also that the capacitor form of reaction control is used.

When 'adjusting' this set, the text notes that the set may be prone to oscillations if the wave trap and the tuning circuit are 'too closely matched'. This of course makes sense. The solution is to judiciously adjust the interplay of the wavetrap, C2 and the tapping of L2.

One other feature is the use of multi circuit jacks instead of a switch. The diagrams are not particularly clear in this regard, but A+ goes to both the middle bar of the output jack (J2), which we can call the 'wiper', and also to the top bar of the first jack (J1). The diagram is unclear here, but this bar would be normally open. The top bar of the output jack is also connected to the normally closed bar of J1. Now if the speaker plug is inserted into J1, the second bar is lifted and connects to the top bar, thus connecting A+ to V1 and V2. By virtue of the A+ connections to J2, V3 is switched off.

Now, if the speaker is connected to J2, the 'wiper' bar is lifted and connects A+ to V3. At the same time, A+ is also connected to the third bar of J1, which is normally closed to the 'wiper' (i.e. the second bar of J1) and thereby connects A+ to V1 and V2. Very neat...

The circuit in Fig.4 is a simplified version and appeared merely three weeks later in the issue for March 11th. Here the wavetrap is much simplified, consisting of L1(a) and (b). Quite detailed instructions for the windings of these coils are given. The wavetrap is curiously described as a 'reaction' unit. Just where these wacky names came from is anyone's guess. Perhaps the marketing philosophy was that if a particular feature didn't have a distinguished name, then it wouldn't be distinguished!

The remainder of the circuit is quite conventional, with the usual provision of alternative speaker jacks. In this instance, V3 is in circuit regardless of where the speaker is connected.

Summary

TECHNICALLY, 1927 was very little different from the two preceding years. Radios were still battery powered all-triode TRFs, sometimes neutralised, still with three-dial tuning and filament rheostats to complicate matters. Yes, prices had come down, and the new low consumption valves previously mentioned brought the purchase price and running costs down even more. In some ways, it marked the end of an era.

1928 was a far, far different story, but that story will have to await another day. ❖

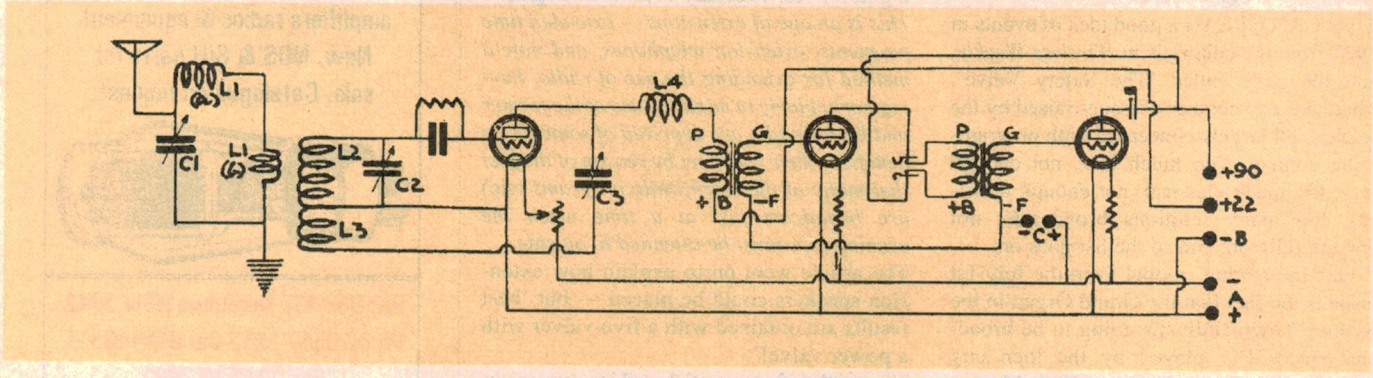


Fig.4: A similar but simpler receiver with a built-in wavetrap, published in WW for 11/3/27.

Information Centre

by Peter Phillips

Magnetism, DC generators, LEDs and haze detectors

This month we look at one of the most basic aspects of electricity: generating DC with electromagnetism. You might be surprised at what really happens. We also discuss magnetism (what is it?), applications that use a LED as a receiver, and present a few reader questions. But first...

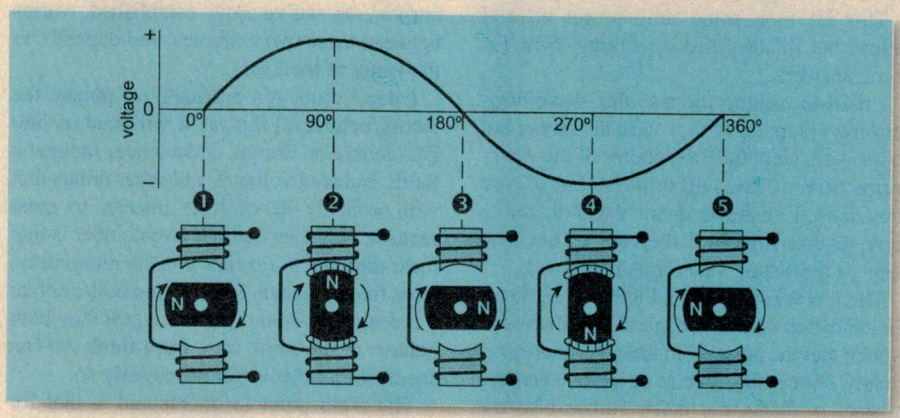


Fig.1: Is this diagram really correct? Yes — and no, as it happens! See text for a full explanation.

DOES THE WAVEFORM in Fig.1 have the correct phase relationship with the position of the magnet? I addressed this question in August, but it has a history going back almost six months, when I described the Pixii DC generator, in particular its commutating device. At the time, a reader (Kees Lindeman) wanted to know the relationship between the commutator and the rotating magnet.

I said switching should occur when the magnets are facing the pole pieces, and that's when the letters started. I expanded my explanation in August, but more letters arrived, all claiming I was wrong. The following letter comes from a physics teacher and is typical of what most people are saying:

I was disappointed to see the error you made in the May issue when discussing the Pixii DC generator and the connections to the commutator. I assumed you would realise your mistake, but you've repeated the error in the August issue, with an incorrect diagram to back it up (Fig.1).

The voltage generated in a coil interacting with a magnetic field is proportional to the rate of change of magnetic flux through the coils. The diagram would be correct if the graph was showing the strength of the magnetic field through the coils. The voltage would then be 90° out of step with this and give maximum voltage at points 1, 3 and 5, and zero at 2 and 4. The equation you give on page 69 is not appropriate as it refers to the voltage generated in a conductor of length l moving at velocity v perpendicular to a magnetic field B. A better equation is $e = -d\Phi/dt$.

If you don't believe this, try it out for yourself. Drop a bar magnet through a coil connected to a CRO. The voltage will increase as the magnet enters the coil, drop to zero as the magnet reaches the centre of the coil, then increase in the opposite direction as the magnet leaves the coil. Note that while the magnet is in the centre of the coil (or for a long magnet, when the coil is in the centre of the magnet), the magnetic field is at its maximum value, but not changing, so the voltage is zero. You might like to try spinning a bar magnet in front of a coil connected to a CRO. You'll find the waveform is nothing like a sinewave, but it will be zero as the pole moves closest to the coil.

Another way to look at the problem is to realise that a motor and a generator are basically the same. Referring to Fig.1, you should then be able to see that the current through the coil should be switched at points 2 and 4 if this system is to work as a motor. (A. Torrens, Hornsby NSW)

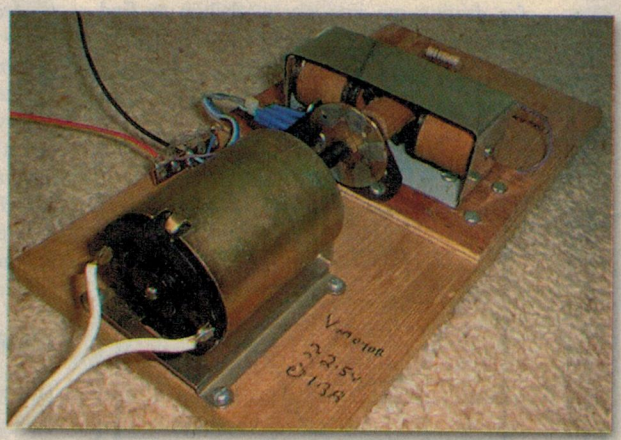


Fig.2: The test jig I used to see if Fig.1 is correct.

Given your background Mr Torrens, and the number of letters supporting you, it's clear we need to solve this problem. You see, while the textbooks and other readers agree with you, I know from practical experience that there's a bit more to this. After discussing the issue with *EA* staff members Jim Rowe and Rob Evans, it was finally decided that the only way to solve the question was to build an experimental device like the alternator in Fig.1 — which is what you also suggest, Mr Torrens.

The test jig I built is shown in the photo (Fig.2). It has a bar magnet held in a short length of wooden dowel, with two brass screws inserted in both ends of the dowel to act as a shaft. The magnet assembly (rotor) is between two opposing coils, each with about 4000 turns wound on 10mm steel rod. The coils are supported by a soft iron 'stator' to

complete the magnetic circuit between them. The rotor is turned by a DC motor.

To sense the position of the magnet, I fitted a disc to the rotor shaft, with a 2mm hole drilled in the disc. This disc turns inside an opto-interrupter, which produces a pulse when the magnet is facing the coils. This setup therefore allows the output voltage from the alternator to be phase-related to the position of the magnet, without any ambiguity.

This all took some time to set up and adjust, but finally I had it working. Now for some answers.

I tried to capture the resulting waveforms into my computer with a 'virtual' scope, but to no avail. Hopefully the photos of the waveforms from a DSO will turn out, but in case they don't, I've drawn them. You'll therefore have to take my word they are an accurate copy of the actual waveforms I obtained.

The first waveform is in Fig.3, which shows the unloaded output voltage of the alternator. Notice that the pulse from the opto-interrupter clearly shows the voltage is zero when the magnet is facing the coils. Notice also the rather strange output waveform, which can be explained by the action of the magnetic field and the rather imperfect construction of the alternator. But before you all cheer and say 'told you so', consider the waveform in Fig.4.

This waveform is when the alternator is loaded with a 100Ω resistor. Notice now that the pulse from the opto-interrupter shows that the voltage is a *maximum* when the magnet is facing the coils. That is, there's a 90° phase shift between the unloaded and the loaded output voltage.

While I haven't drawn waveforms to show it, I also found the value of the load resistor determines the phase relationship of the output voltage to the position of the magnet. Obviously inductance is playing a role here. Therefore, to convert the output voltage to DC, the relationship of the commutator to the magnet depends on the value of the load.

For full load, switching must occur when the magnets are at 90° to the coils, not when they are in line with the coils. Which is what I've claimed all along. But at no load, switching should be when the magnets are in line with the coils, which I guess is what everyone else has been saying. The real answer, as we've now established, varies between these two extremes, and depends on the value of the load.

I don't think it's profitable to pursue the theory behind all this, as it will lead us into DC generator design, inductance, magnetic fields, induced voltages and other things that will probably be of little interest to most readers. However a point to remember is that most alternators (except bicycle alternators) have fixed magnets and rotating coils, unlike our design. It's tempting to suggest they both behave in the same way, but I think we can see now that this is not necessarily so.

The main point to understand is that for Fig.1, things are very different when the generator is driving a load compared to the unloaded case. So we really need to add a load resistor to Fig.1 to make it correct.

A final point is that the theory behind motors and generators can be very tricky. It's really a subject in itself, and perhaps more appropriate to electrical design, not electronics. However I'm sure many readers will have found our discussion interesting. If nothing else it's reinforced the principle that looking at the output of an unloaded voltage source is not a reliable guide to its operation when connected to a load. My thanks to all those who contributed to the discussion, and for driving me into my workshop to find some answers by experiment, not by theory.

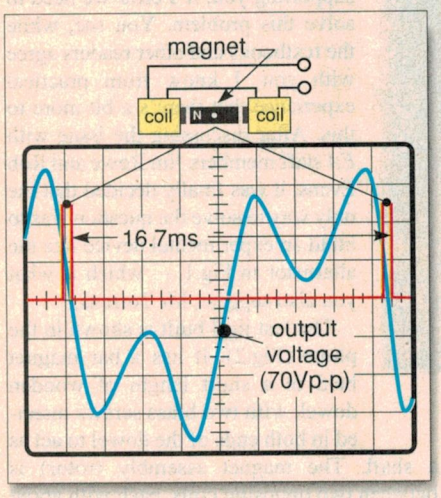


Fig.3: Waveforms obtained from the test jig with no load

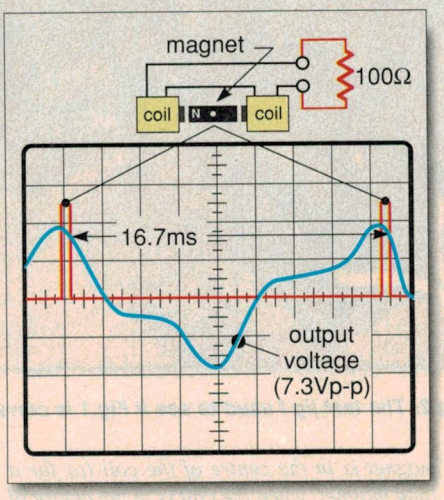


Fig.4: Waveforms obtained with full load — so Fig.1 needs a load resistor.

Lorentz contraction

THE NEXT letter is in response to a question about magnetism (by Ted Sherman) in the May column. Ted wanted to know what magnetism is, and perhaps this letter gives us a clue:

Magnetism is indeed a mystery, as in the end most things are. But science has progressed by seeing that some seemingly quite different phenomena are intimately related, such as electricity and magnetism. Hence electromagnetism.

Some years ago I was astonished to find it was possible, by starting with the laws of electrostatics, not magnetism, to explain why two parallel wires carrying currents in opposite directions repel each other. You only need an elementary knowledge of Special Relativity and the ability to follow a logical argument. I can't go into it all in this short letter, but it's clearly explained in a book called Electricity and Magnetism, by E.M. Purcell (McGraw Hill), in Chapter 5.

The aspect of relativity used is that of the Lorentz contraction, by which an object of a certain length appears shortened when viewed from another frame of reference moving with respect to the first. With no current in the wires, the electrostatic forces between the positive ions and conducting electrons in the wires cancel, because the positive and negative charge densities in the wires are the same. When current flows, the Lorentz contraction comes in to play, and the charge densities of the electrons are changed. The result is the electrostatic forces do not quite cancel, leaving a residual repulsive force.

Hence the magnetic effect is just the result of the electrostatic charges not quite cancelling out. Similar arguments can be used to deduce the well known generator and motor rules in magnetism, connecting field, current and motion. Amazing, eh! (David Cooke, Parkes, NSW)

David sent me a copy of the relevant chapter. It's fairly mathematical, but it certainly puts another view of magnetism. I'm not sure if Ted will feel his question has been answered by this, but it's interesting to see just how far reaching Einstein's theories are.

Photovoltaic LEDs

IN THE APRIL column I was foolish enough to tell everyone that I was not aware that LEDs were photovoltaic. Furthermore, when I conducted a number of tests on a LED to determine its voltage and frequency characteristics, I didn't detail my test methods. So, I guess a few readers will agree with the following letter:

I'm a fan of your column, but I want to

raise a few points on your discussion of photovoltaic LEDs. Firstly, all diodes exhibit some form of response to incident light. Secondly, it has been known since they became available that a LED responds best if illuminated with its own spectra. Several short distance optical communication designs that use same colour LEDs as Tx/Rx components have been published. I was therefore rather surprised to find that a person such as yourself would be ignorant of these points.

But thirdly, due to the hysteresis inherent in fluorescent tube phosphors, it would seem that a switching rate of some 28kHz would not be optically detectable to any great degree. I suggest you were instead monitoring the radiated electrical field around the fluorescent tube. This can be quite large compared to any photoelectric effect, and would tend to fool a novice with no experience of scientific methods.

To take the methodical approach I have come to expect from other contributors to your magazine, the experiment should have been repeated with a known standard photodiode, and then with EM field detectors (inductors, probes etc). Unfortunately you seem not to have bothered with such care in this instance.

In the past I too have been guilty of half-cocked unproved guesses, but never have I been naive enough to publish without further experimentation to support my findings. I sincerely hope that EA won't go from having a reputation of 'Virtus Non Stemmus' to 'Stemmus Non Virtus' under your gently guiding hand. In closing, may I suggest you use a Tx LED driven at higher frequencies by a frequency generator to determine the receiving diode's upper limit. (Michael Chevallier, Killara, NSW)

Fair points Michael, but be assured my test methods were not as crude as my brief description in April might suggest. First, though, why didn't I know LEDs are photovoltaic? I had never thought about it! That's all. After all, while I've known for most of my life that a PN junction responds to light, I've never regarded a LED as having a conventional PN junction...

Now to tackle your justifiable concerns about my apparently sloppy test methods to measure the frequency response of a LED. The 'fluorescent' tube I used in the test was in fact a 'tiny tube' as used for LCD backlighting. I didn't mention this at the time, as I was still developing the tiny tube lights that have since been published in the magazine. These tubes behave more like a neon than a fluorescent tube, despite their appearance. I had discovered this while developing the strobe/beacon light described in the May edition.

They don't exhibit any hysteresis (that I can measure), and their low power consumption (3W or less during my test) means the EM field is very small. But, being aware of the EM phenomenon, I tried a range of positions for the LED, including holding it some 500mm from the tube. I could go on, but I think you can see my experiments were not really 'half-cocked'. In any case, I didn't claim my tests to be exhaustive, but merely indicative.

I thought of using a LED driven by a frequency generator as the test light source, but as I had no idea of the frequency response of a LED either as a transmitter or receiver, I decided on the tiny tube light. After all, one unknown in an experiment is better than two.

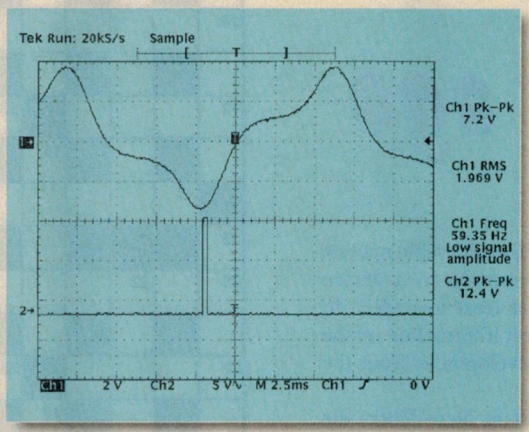


Fig.5: I asked EA editor Jim Rowe to see if he could capture the waveforms of Fig.4 using his Tektronix DSO. Here's what he obtained, which as you can see shows the same phase relationship for the 'loaded' situation.

On the topic of applications for LEDs as receivers, I'll let readers explain...

IR remote tester

BY FAR the most useful Circuit and Design Ideas presented over the last year or so was an IR diode (BPW50) built into a BNC plug for testing the output of an IR remote control unit. Simply plug the device into the vertical input of a CRO, point the remote at it and see what's happening.

As I recall, the reader who suggested it didn't win first prize, so you're probably not the only one at EA who's a little slow. I enjoy your column just the same. (J. Harvey, Clermont, Qld)

A little slow — what cheek! Still, thanks to Mr Harvey for bringing this excellent idea to everyone's attention again. A simple but useful device.

Haze detector

A READER (Ernst Voigt) sent me a photocopy of a rather interesting construction project published in *Scientific American* May 1997, under the heading The Amateur Scientist. This very simple device can be used to monitor haze, and was designed by Forrest M. Mims III. It's quite a significant design, judging from the text describing the project. Here's an extract...

Most professional haze instruments use a broad-spectrum photodetector, coupled with an expensive narrow-band filter to achieve the necessary selectivity. Mims realised that a narrow-band detector would serve the same purpose. The perfect device for an amateur scientist is a LED, which generates light of a sharply defined colour.

But this process is easily reversed: light falling on a LED creates a small current. Furthermore, just as LED emissions appear only in a narrow wavelength band, the diode generates current only when stimulated by light within a small range of colours. Mims' device uses a green LED, which emits light at around 555nm, and detects light at around 525nm. The rest of the circuit consists of one resistor, an op-amp, two 9V batteries and a voltmeter. (by Shawn Carlson, *Scientific American*, May 1997)

This illustrates another aspect of the photovoltaic characteristics of a LED: bandwidth. I didn't pick this up in my tests, as the light output from a tiny tube is pure white, therefore covering the entire visible spectrum. So it seems LEDs are indeed quite useful in receiver applications.

What??

I KNOW some readers like mathematical problems, so try this one. It comes from Bruce Howard (Collingswood, SA), who asks:

A sheep is tied to the perimeter of a circular field with a radius of 100 metres. How long should its lead be so it can eat grass covering an area of exactly half the field (ignoring things like length of its neck etc)? The solution Bruce has provided might not be the only method, so Bruce also asks for the simplest solution, and whether there's an electrical analogy to the problem (as in the two ladders problem). Could be tricky!

Answer to September's What

THE LENGTHS measured in modern science range from the radius of an electron (about 10^{-13}cm) to the distance of the most remote parts of the universe (about 10^{25}cm). The *ratio* between the two is therefore a factor of around 10^{38}, but the *difference* would probably still be around 10^{25}cm. ❖

Electronics Australia **is one of the longest-running technical magazines in the world. We started as *Wireless Weekly* in August 1922 and became *Radio and Hobbies in Australia* in April 1939. The title was changed to *Radio, Television and Hobbies* in February 1955 and finally, to *Electronics Australia* in April 1965. Here are some interesting items from past issues:**

50 years ago

October 1948

Germanium Crystal may replace Valves: Considerable interest has been created by references in recent months to a device which may render radio valves obsolete, at least in respect to many of their present-day applications. Latest information on the subject reveals that the 'transistor' is a development from the wartime germanium diode.

Invented at Bell Telephone Laboratories in New York, the transistor's operation is possible because the ability of a semiconductor to carry electrical current can be controlled. This is done by changing the electronic structure of a small bit of material under the influence of the incoming current, fed to it through a fine 'Cat's Whisker' wire. The current coming out of the other wire, just about two thousandths of an inch away, is boosted in volume a hundred fold.

Germanium metal specially treated is the semiconducting material used, but others include silicon and some metal oxides.

The transistor as now developed was reputed to have a frequency limitation of about 10,000,000 cycles per second, but it promises to be quite satisfactory in the television ranges.

25 years ago

October 1973

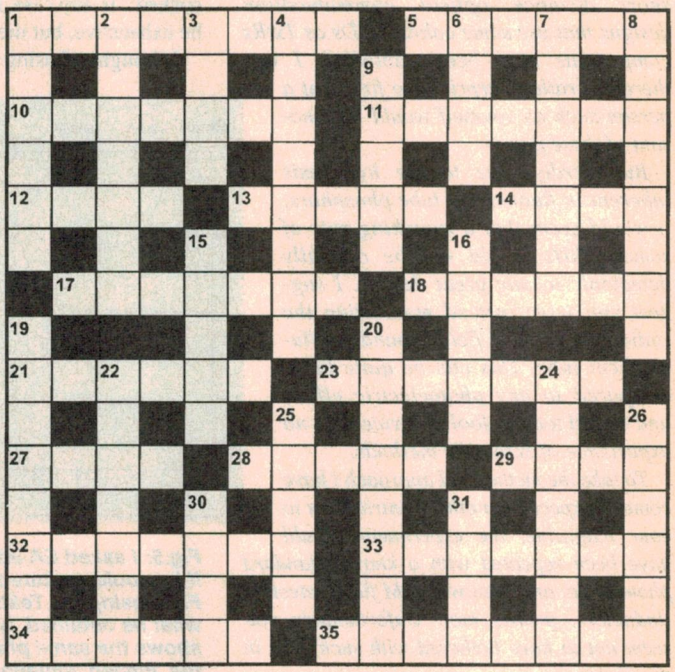
Radar Reveals Craters on Venus: Radar observations made from the Goldstone Tracking Station in California have revealed the existence of large, shallow craters in the near-equatorial zone of Venus. The studies were performed by a team of radar astronomers under the direction of Dr Richard A. Goldstein of the Jet Propulsion Laboratory (JPL).

The Goldstone installation employs a 400kW transmitter operating at a frequency of 2.388GHz, a 64 metre antenna and a 26 metre antenna. Signals are transmitted by the 64m antenna and the return signals received by both antennas. This enables the system to be used as an interferometer, which result in a resolution of about 10 kilometres.

Rechargeable Cardiac Pacemaker: Scientists and doctors at the Johns Hopkins University Applied Physics Laboratory recently held the first public demonstration of their new heart pacemaker, which is both long lasting and much smaller than conventional units. The new pacemaker uses electrical and electronic components first designed by NASA for use in spacecraft.

The pacemaker incorporates a modified version of space satellite power cells, specially designed for implanting in the body, and a new lead wire to match its longevity. ❖

Crossword



Across

1 Send a signal. (8)
5 Devices that involve rotating disks, etc. (6)
10 Constituent element of a semiconductor. (7)
11 Natural spectrum display. (7)
12 Gradual loss of charge. (4)
13 Image of beam deflection. (5)
14 Prefix indicating a billionth. (4)
17 Devoid of voltage. (7)
18 Type of current. (6)
21 Ionised region of the atmosphere. (1-5)
23 Government department. (7)
27 Magnetic weapon. (4)
28 Rough edge of moulding. (5)
29 Part of transistor. (4)
32 Early communications satellite. (7)
33 Electronegative element. (7)
34 Circle of light. (6)
35 Element used in certain capacitors. (8)

Down

1 Type of switch. (6)
2 Said of radio with wide frequency range. (3-4)
3 Packing washer. (4)
4 Maritime communications body. (8)
6 Running surface for an electric loco. (4)
7 Oscillate. (7)
8 Shape of certain very useful waveform. (8)
9 Dismantle for spares. (5)
15 Volatile solvent. (5)
16 Clock. (5)
19 Sealed airtight. (8)
20 Part shadow. (8)
22 Ring-shaped. (7)
24 Type of cable. (7)
25 Passage of current across a gap. (5)
26 Discharge a pledge. (6)
30 Exert control via a high voltage. (4)
31 Initiate the correct operational state. (4) ❖

September's solution:

W	A	V	E	F	O	R	M		J	I	T	T	E	R
A		I		L		O		B		R		R		E
R	E	L	O	A	D	S		O	P	E	N	I	N	G
B		L		G		T		O		E		T		I
L	E	A	D		S	E	N	S	E		P	I	P	S
E		R		S		R		T		P		U		T
	W	I	N	C	H		H	E	L	I	U	M		E
V				O		P		R		L				R
E		F	E	R	R	I	C		M	O	U	S	E	
R		R		E		R	A		T		T		B	
B	I	O	S		V	A	C	U	A			T	U	B	A
A		N		P		T		R		H		D		R
T	E	T	R	O	D	E		O	P	A	C	I	T	Y
I		A		L		D		R		I		E		O
M	U	L	L	E	R		H	A	R	R	I	S	O	N

Electronics Australia's

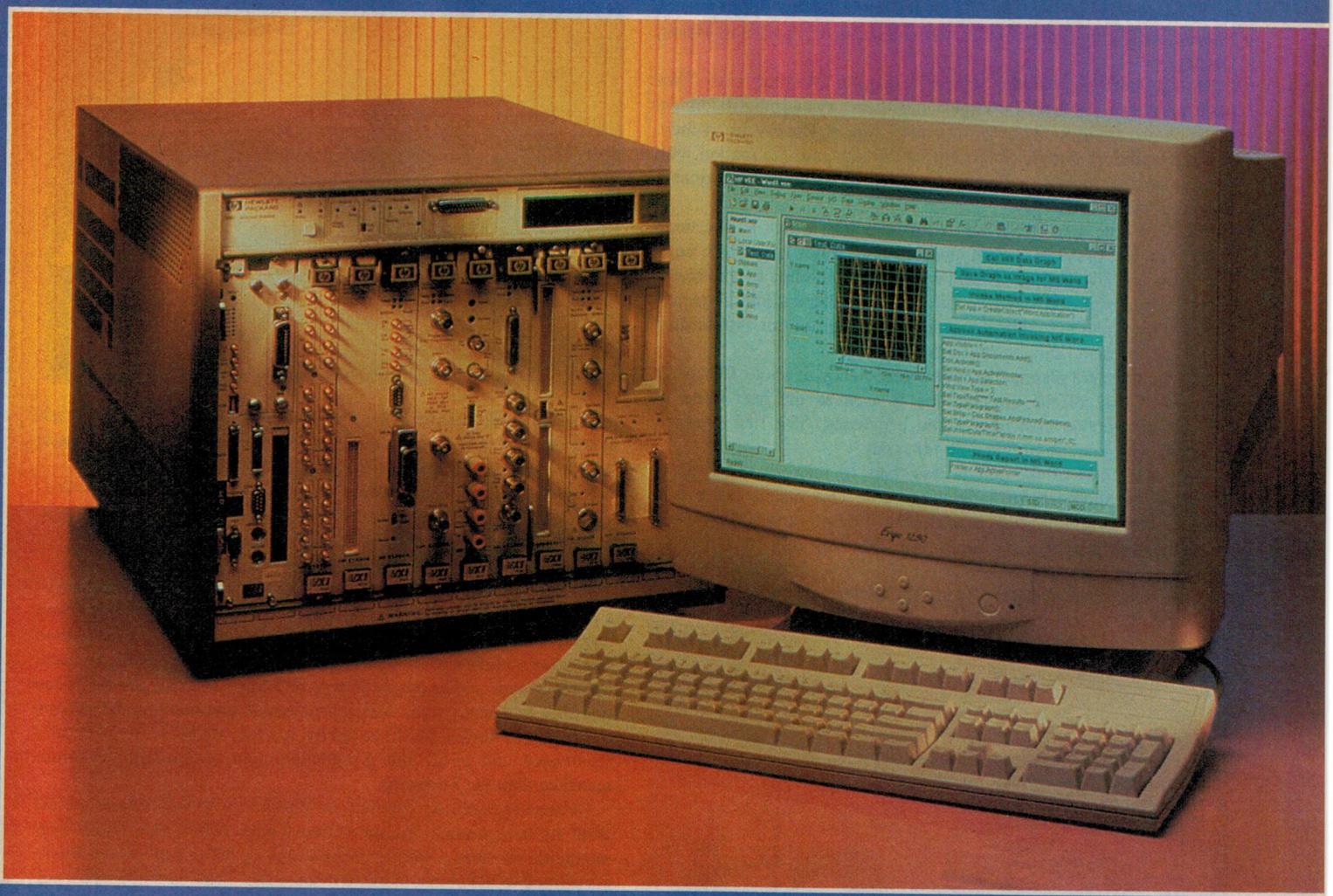
Professional Electronics

Another chip production breakthrough by IBM: silicon on insulator technology, promising 35% faster chips

PM opens new Sydney R&D software development lab for Lucent Technologies

New Tektronix DMM offers DSP-based true RMS reading

Feature on the latest Test and Measuring Instruments



Hewlett-Packard's enhanced VEE 5.0 Visual Programming language for T&M: adds support for ActiveX controls and IEEE-1394 FireWire — *plus* a built-in Web Server...

highlights News

Prof. Green (L) and Mr Hogg.

Largest thin-film silicon solar cell

SIX MONTHS ahead of schedule, Australian firm Pacific Solar claims to have produced the world's largest thin-film crystalline silicon solar cell.

Pacific Solar is a $64 million joint venture between Pacific Power and University of NSW's technology commercialisation and research company, Unisearch Ltd. It intends being the first major producer into global markets with renewable energy electricity able to match the cost of electricity from conventional fossil fuels. By the end of 2001, Pacific Solar expects to be in full-scale production of its breakthrough technology, pioneered at UNSW's Photovoltaics Special Research Centre under the direction of Professor Martin Green.

Mr David Hogg, Pacific Solar's Managing Director, said: "We have produced the world's largest thin-film crystalline silicon, on glass photovoltaic modules on our pilot line at Botany in Sydney. We are confident Pacific Solar will be the first into the market with a commercial product offering a cheap, long-term, sustainable source of clean electricity."

"Each module measures 30 by 40 centimetres, which is five times larger than our previous largest, and about 12 times larger than commercially available cells. Our team will use the pilot line to continue to improve the design and to reduce the cost of the solar modules. The pilot line will also help our engineers refine the design of our first factory, which we will start building next year", he said.

The modules are planned to have an efficiency of about 15% as, at this early stage of the project, this is seen as the best trade-off between production cost and output efficiency. The first products from the pilot line are in line with this goal.

The active part of the cell is less than 10 microns thick, about 1/40th of the thickness of competing cells. This means that a full-scale factory would produce modules for little more than the cost of the glass used to protect and support the thin-film cell.

Mr Hogg said Pacific Solar aimed to be producing modules, each about one metre square, by the end of 2000. Each module will have its own inverter for direct connection to electrical circuits.

News of Pacific Solar's new cell was one of the big announcements made at the Second World Conference on Photovoltaic Solar Energy Conversion, held in Vienna in July.

Video motion sensor recognises gestures

JAPAN'S TOSHIBA Corporation has announced the development of a prototype motion processor that supports real-time recognition and display of kinetic, three-dimensional objects on a PC. The motion processor's ability to recognize and detect the movements of hand images is expected to point the way to a more natural, gesture-based interface between people and computers. A commercialized version of the processor will facilitate access to computers for the physically challenged and aged, and provide children with a simpler-to-use interface than the keyboard.

Gesture recognition depends on the ability to separate an object from its background. In conventional approaches, this object segmentation requires a simple background, or the use of special markers affixed to the object to make it stand out. Toshiba's new approach has produced a motion processor able to detect a hand against any kind of background, however complex, and if required display it in real time as a moving 3D image.

The new motion processor receives infrared light which is emitted from a light source and reflected by the hand. The dissipation of the light ensures that the intensity of reflected light from the background is too weak to detect. Moreover, by using the

reflectance and directional information of the object surface, the motion processor is able to use variations in reflected light intensity to construct a 3D image of the hand.

The prototype motion processor consists of eight infra-red LEDs, a lens, a CMOS image sensor, and a dedicated LSI chip that synchronizes transmission and reception of the light signal. It delivers a seven-bit, 64 x 64 pixel image to the PC, at a rate of 30 or 50 frames a second. The processor has an object range from 30 to 90cm, and covers an area 400mm square. It has a PCMCIA interface to the computer.

The interactive potential of the motion processor can be seen in two successful test applications: playing the traditional Japanese game of 'Rock, Paper, Scissors' against a computer, and a virtual conductor game, in which different hand movements generate various sounds. The commercialized image processor will provide support for computers that recognize sign language and advanced interactive applications in multimedia and edutainment.

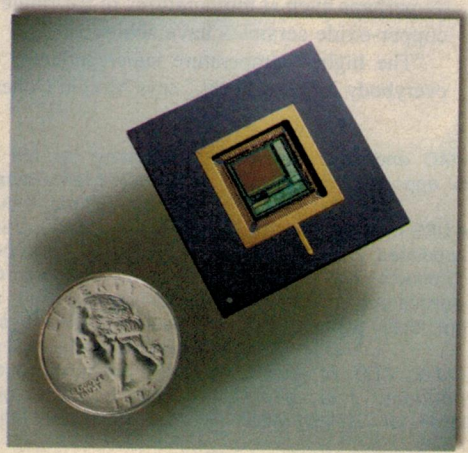
Schaffner's new Profline open-architecture EMC testing platform is said to provide a highly flexible facility for testing domestic, commercial and industrial appliances, configured using any instruments with VXI, IEEE488 or RS-232C interfaces. For more info contact Westek Industrial products, (03) 9369 8802.

PM opens Lucent's local Bell Laboratory

IN A CEREMONY attended by Prime Minister John Howard, Lucent Technologies officially opened Bell Laboratories Australia, claimed as the company's largest R&D software development centre outside the USA. The new facility is expected to provide a major boost to Australian technology.

Bill O'Shea, group president of Lucent's Business Communications Systems and Data Networking Systems group, and Dave Johnson, international president of Business Communications Systems, also took part in the ceremony. Bell Labs is Lucent's R&D arm.

At the event Bell Labs demonstrated some of its recent inventions, including the CMOS low power 'camera on a chip', (R) which produces high resolution real-time video images rivalling those from conventional CCD imagers — using Bell Labs' 'active pixel' technology. This technology has just been licensed to Taiwan-based Vanguard International Semiconductor Corporation, and is expected to be used in the next generation of digital video and still cameras.



Sydney's Bell Labs R&D facility started with a group of six engineers in 1994, and now has a staff of 40 top scientists and engineers. According to executive director Scott Coles this is likely to grow to 90 within five years, making it one of the largest facilities of its kind in Australia.

Resource web site for digital TV

ANALOG2DIGITAL, A WEB site containing comprehensive information and resources dealing with the conversion from analog to digital television, has made its debut on the World Wide Web. Located at **http://www.analog-2digital.com**, the site is a high-quality, worldwide resource for unbiased information on digital television transitioning and related issues.

Analog2Digital is targeted to groups who face the daunting challenge of converting from analog to digital TV signal transmission over the next few years, as mandated by the US Federal Communications Commission (FCC) and as already begun by such international groups as the Digital Video Broadcasting Project and the European Broadcasting Union. Potential site users include cable, satellite, and telecommunications providers, as well as terrestrial broadcasters, television content providers, equipment manufacturers, and video and engineering students and professors. The site provides timely, relevant information on market, business and industry news; regulatory issues; standards; trends and technology.

Analog2Digital is sponsored by Tektronix Inc., a Wilsonville, Oregon-headquartered company, and a leading provider of test and measurement, video and networking, and colour printing products.

First 1.66M pixel CCD image sensor

TOSHIBA CORP has announced what is claimed as the world's most pixel-packed CCD area-image sensor for digital still cameras. The TCD5603D provides a 1.66-million pixel count image resolution that is claimed to enhance image quality. The new CCD was planned to begin mass production in August.

The TCD5603D is a 1/2" interline CCD area image sensor with approximately 1.66 million pixels (1590 x 1042). The pixel cells measure 4.85um square. Each individual pixel has an RGB primary filter, organized in a cross-striped array so that pixels with a green filter are always diagonally adjacent to one another. Four-field interlace scanning combines data from four pixels in forming individual fields, at a maximum of 8.8 frames a second. Maximum horizontal drive frequency is 15.8MHz. The image aspect ratio is 3:2, but the huge pixel count supports viewing on 16:9 wide-screen TVs,

and 3:1 panoramic views.

The TCD5603D interfaces with a range of data storage systems, including SmartMedia — fast emerging as the de facto image storage system for digital still cameras.

Major awards for HP's Infinium, LogicDart

HEWLETT-PACKARD'S Infinium high-performance oscilloscope and LogicDart advanced logic probe have won a total of 10 awards in less than a year, from key test and measurement and electronics engineering and design publications. HP says the fact that these instruments have won so many awards in such a short period of time — and have been so well-received in the marketplace — underscores the importance of HP's customer-oriented approach to product development.

The HP Infinium oscilloscope captured *EDN* magazine's prestigious 'Innovation of the Year Award' in the test and measurement product/technology category. In addition, *Design News* named the Infinium one of the Best Products of the Year, while *ECN* designated the scope for its Editor's Choice Featured Product Award, and *Test & Measurement World* honored it with a Best In Test Award.

LogicDart, HP's advanced logic probe for trouble-shooting fine-pitch digital circuitry, gained a Reader's Choice Award from *Evaluation Engineering*. In addition, *Electronic Products* honoured LogicDart as its Product of the Year, while *Test & Measurement World* chose LogicDart as its Test Product of the Year.

HP's 30M LaserJets

HEWLETT-PACKARD HAS claimed continuing leadership in the worldwide printer market, after announcing the shipment of its 30 millionth LaserJet laser printer, 14 years after revolutionizing the desktop printing market. HP introduced the LaserJet to market in 1984, with strong sales which passed the one million mark in 1988, and the 10 million milestone in 1994.

Clare Tipler, HP Australia's market development manager for LaserJets, believes that HP is still unlocking market opportunities. "Although the percentage of information that users are printing is decreasing, the amount of information available to them is increasing so rapidly that users are printing more and more. HP LaserJets enjoy such worldwide popularity because of their high quality output, reliability and their speed."

According to Ziff-Davis StoreBoard, an independent source for sales data from corporate, retail and mail-order distribution channels, HP also produces the world's most popular colour laser printer. Based on May 1998 data, the HP Color LaserJet 5M printer is the market-share leader with 62.4% of the colour laser-printer market.

Schlumberger's Test & Transactions Division is building a new centre in Korea to design and manufacture semiconductor testing systems. Here a photographer captured a gaggle of executives, helping out the builders by digging for the foundations...

...and here's one of Schlumberger's new DX2001 memory chip testing systems, developed in close consultation with Samsung. Thanks to liquid cooling, it can test up to 64 chips simultaneously at speeds up to 333Mb/s.

Hottest superconductor could be Carbon-36

A TEAM OF THEORISTS at the US Department of Energy's Lawrence Berkeley National Laboratory, whose calculations motivated the successful synthesis of materials based on carbon-36 fullerenes, has calculated that these systems may lose all electrical resistance at temperatures far higher than any other carbon structure — perhaps even at temperatures in the range that superconducting copper-oxide ceramics have achieved.

"The highest-temperature superconductor is the home run that everybody is trying to hit," says Marvin Cohen, who with Steven G.

IN BRIEF

- John Robinson has been appointed Regional Sales Manager for the Microelectronics Division of ***IBM Australia and New Zealand***. Previously managing director of BBS Electronics Australia, Mr Robinson will be responsible for raising the profile of the company's embedded processors, ASICs and other high-end semiconductor products.
- ***Computer Sciences Corporation*** has appointed George Bell as managing director of CSC Australia. Peter Rehn, who has been MD and CEO since 1984, has been appointed full-time chairman.
- Power system and UPS manufacturer PK Electronics has appointed ***Eltek Pacific*** to distribute its products in Australia. Eltek will provide service and support for the products from their Sydney and Brisbane offices.
- John Fahey, former CEO of Audio Products International, has been appointed Director of Sales and Marketing for hifi product distributor ***Convoy International***. Mr Fahey is well known in the industry, from his 20 years with Yamaha Consumer Electronics and before that, at the Maurice Chapman Group.
- Melbourne-based imaging technology specialist ***Deeper Image*** has formed a new subsidiary to specialise in corporate-commercial business, called ***Solex Group***. Both firms are based at 205-207 Elgar Road, Box Hill 3128. ❖

Louie heads a theory group in Berkeley Lab's Material Sciences Division (MSD); both are professors of physics at the University of California at Berkeley. "Even if the carbon-36 materials don't achieve this, they give us a new class of solids to help develop our knowledge about this field."

Cohen says, "If you intercalate potassium atoms among the planes of graphite, even graphite becomes superconducting — but at half a Kelvin", an inconveniently low temperature. "On the other hand, C-60 'buckyballs' doped with alkali metals can be superconductors at up to 40K. Part of the explanation seems to be the curvature of the ball."

A closed carbon structure with more overall curvature than C-60 is expected to have fewer atoms; while fullerenes smaller than C-60 have been observed, experimenters Charles Piskoti, Alex Zettl, and Jeff Yarger of UC Berkeley, who are also with Berkeley Lab's MSD, were the first to extract an appreciable amount of C-36, having been encouraged by the Cohen-Louie group's theoretical calculations. The Zettl group announced the isolation of bulk samples of C-36 in *Nature* on 25 June 1998.

While preliminary results indicate the possibility of raising the superconducting temperature of C-36 above the boiling point of nitrogen at 77K, whether it can be raised even higher — above that of the present record-holder, which at ambient pressure becomes superconducting at 135K — is uncertain.

Hewlett-Packard has released a new publication 'Making Radiated and Conducted Compliance Measurements with EMI Receivers', to assist engineers and technicians in EMC testing. Copies are available free by calling HP's Call Centre on 1800 629 485.

Audiosound turns 30

AUSTRALIAN AUDIO and hifi manufacturer Audiosound Laboratories (originally Audiosound Electronic Services) has celebrated its 30th anniversary, having been founded by current MD Ron Cooper in 1968. Many examples of the company's first hifi amplifier, the LD-30, are still performing well.

Over the years Audiosound has supplied hundreds of amplifiers and speaker systems to the ABC and numerous broadcasters, professional studios and music lovers. The present speaker range includes eight models which have won Australian Design Awards.

The company's latest audiophile amplifier system is a separate power amp-preamp combination with passive switching combined with state of the art analog circuitry, novel filters and ultra-reliable MOSFET power stages of 50W and 100W per channel. In addition they are offering to special order only their new high performance all-analog radio tuners, in both FM only and AM/FM models. These units are all hand made, with the coils made in house and all stages critically aligned. Prices are $2290 and $2940 respectively. (For more information contact Audiosound Laboratories, 148 Pitt Road North, Curl Curl 2099.)

Microsoft to build Silicon Valley campus

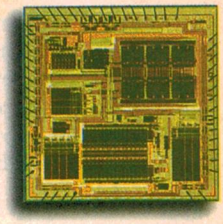
MICROSOFT HAS BEEN mining the Silicon Valley for technology almost from its outset. Now, in an effort to have even more ready access to the best and brightest ideas and engineers in the area, the Seattle software giant will set up a 32-acre corporate 'satellite campus' in the heart of the world's premier high-tech industrial region.

The five-building complex in Mountain View will be located only a stone's throw from one of Microsoft's fiercest rivals, Netscape Communications, and only a few blocks from Sun Microsystems. The campus will have some 515,000 square feet of office space and employ about 2000 people.

The unit will be home to Microsoft's Bay area sales and marketing staff, the firm's graphics product unit and divisions that develop Internet products for the Apple Macintosh computer. Microsoft will also consolidate the 800 other employees it has working through out the Valley and provide a new home to Microsoft subsidiaries such as @Home, WebTV and Hotmail.

"We've certainly learned as we grow as a company — the best expertise today not only lives in Silicon Valley, it wants to stay living in Silicon Valley. It's a chance to have a real presence, a home, in the Valley", said Microsoft president Steve Ballmer at a ground-breaking ceremony. ❖

Solid State Update



Keeping you informed on the latest developments in semiconductor technology

Plug & Play DAQ system in a chip

Analog Devices has announced a new mixed-signal IC architecture claimed to significantly increase the performance and cut the development time of data acquisition designs. The new ADuC812 'MicroConverter' features high-performance, dual 12-bit DACs and a 12-bit ADC — coupled with Flash Memory and industry-standard 8051/8052 microcontroller cores, as well as support circuitry and several standard serial port configurations. It's claimed as the industry's first truly complete data acquisition system (microcontroller, memory, data conversion circuits) on a single chip.

The ADuC812 is also designed to support the new IEEE 1451.2 Standard for a common interface for transducers. This means that smart transducers, when used with the ADuC812, become network-independent, interchangeable devices.

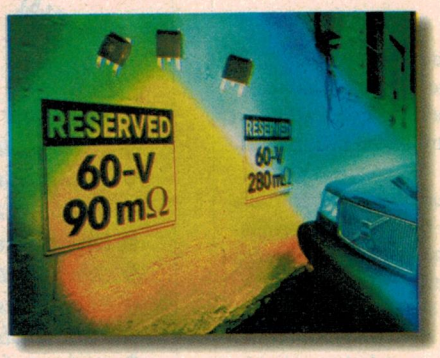
The ADuC812 offers better performance than current data acquisition solutions because it increases the speed and accuracy of the entire sensor system. Because it contains Flash Memory, data and signal processing, it can be programmed to translate any transducer signal into the engineering units a sensor system needs, freeing processing capacity at the system level where the signal translation task is currently performed.

Analog Devices is providing a complete ADuC812 QuickStart Kit to give hardware and software engineers a fast and easy way to program the part. The kit includes documentation, an application board, power supply, a user's development Web site, a serial port cable and a Windows-compatible software package including third party assembler, debugger, serial downloader and simulator applications. The applications board has serial port communications, 32KB of SRAM and a buffered analog I/O.

For more information circle **271** on the reader service card or contact Analog Devices, Suite 4/1621 Point Nepean Road, West Rosebud 3940.

New DPAK TrenchFET options

Automotive electronics purchasers who have experienced delivery problems with DPAK power MOSFETs now have two new replacement options. **Vishay-Siliconix** has released the N-channel SUD15NO6-90L and the P-channel SUD10PO6-280L, both of which are rated for a 175°C maximum junction temperature. The new devices are specified for 4.5V logic-level operation and offer the 60V voltage breakdown rating required for unprotected circuits in the automotive environment.



Typical applications for the new devices will include fuel injector drivers, solenoid drivers for anti-skid braking systems, oxygen sensor heaters, and body/vehicle control. On-resistance at a 4.5V gate drive is 90mΩ for the N-channel device and 280mΩ for the P-channel device.

For more information circle **272** on the reader service card or contact distributors Braemac or Avnet VSI Electronics.

CMOS op-amps have rail-to-rail I/O

Burr-Brown's new OPA343 series of low cost CMOS operational amplifiers feature rail-to-rail input and output and are available in miniature packages. They are specially designed for portable, space-limited, and price sensitive applications.

Optimized for low voltage, single supply operation, the OPA343 series is claimed ideal for driving A/D converters, I/V conversion at the output of D/A converters, and active filters. Excellent AC performance also makes them suitable for audio applications such as headphone drivers.

B-B claims the op-amps feature the industry's best rail-to-rail performance. Input common-mode voltage range extends 500mV beyond the negative and positive supplies, and voltage output swing is to within 1mV of the supply rails. They operate on a single supply as low as 2.5V. In addition, they offer excellent dynamic response (BW = 5.5MHz, SR = 6V/us, THD at 1kHz = 0.0007%), yet quiescent current is only 850uA.

All versions — single, dual, and quad — are available in space-saving miniature packages. The OPA343 (single) comes in the five-lead S0T-23-5 surface mount, the OPA2343 (dual) is available in the MSOP-8 surface mount, and the OPA4343 (quad) comes in the SSOP-16 surface mount. In addition, the single and dual come in standard 8-pin DIP and SO-8 surface-mount packages. The quad is also available in 14-pin DIP and SO-14 surface-mount packages.

For more information circle **273** on the reader service card or contact Kenelec, 2 Apollo Court, Blackburn 3130.

New 10-bit 32MS/s ADC for video, comms

The new **Analog Devices** AD9202 is a complete high-speed 10-bit 32MS/s analog-to-digital converter (ADC) with a host of functions, such as on-chip sample-and-hold, internal voltage reference, and a built-in DC restore clamp function, which ease the design of both video and communications systems. Users of the AD9202 can select a variety of input ranges and offsets and can drive the input either single-ended or differentially. If desired an external reference can also be used, to suit the accuracy and temperature drift requirements of the intended application.

In video applications the AD9202's internal clamp (DC-restore) establishes proper signal offset while the 32MS/s sampling rate makes it ideal for oversampling baseband, composite

video. The excellent differential phase (0.2°) and gain (1%) specifications ensure professional quality signal processing of composite video signals. The AD9202 can be run at 25 - 30MS/s to oversample the colour subcarrier frequency for NTSC or PAL.

With its wide power supply operating range (2.7 to 5.5V) and low-power operation (90mW), the AD9202 fits any battery or power supply configuration for both portable and stationary system applications.

For more information circle **274** on the reader service card or contact Analog Devices, Suite 4/1621 Point Nepean Road, West Rosebud 3940.

Single-chip RF Receiver

Micrel has released its first RF (radio frequency) product. The MICRF001 employs a novel patent-pending technology to integrate a complete radio receiver onto a single silicon chip. Additionally, this new architecture eliminates the manual tuning required to optimise the performance of competing solutions. The IC not only offers competitive and sometimes superior performance, as compared to existing systems, but also allows a user to reduce system costs by over 50%.

Operating in the 300MHz to 450MHz UHF range, the MICRF001 provides claimed benefits including:

- Reduced manufacturing costs, with the elimination of manual tuning and reduced parts count (from as many as 40 to only four);
- Inexpensive, non-precise LC transmitters can be used in conjunction with MICRF001;
- RF design 'black magic' is eliminated, facilitating fast time-to-market;
- Regulatory compliance is eased, by virtually eliminating RF antenna re-radiation; and
- The device offers a seamless interface to standard decoders and microprocessors.

Designed for the high growth wireless data communications market, key applications are in remote actuation systems such as garage door openers, keyless entry systems (RKE), consumer wireless remote controls, DSS remote systems, remote lighting controls, remote control security, and home security.

For more information, circle **275** on the reader service card or contact GEC Electronics Division, Unit 1, 38 South Street, Rydalmere 2116.

'First uncooled laser diode'

Mitsubishi Electric has introduced what it claims is the world's first uncooled laser diode, providing the high reliability and performance of current advanced cooled designs but at substantially lower costs, FU-436SDF-4M1B and -4M1C are designed specifically to enhance CATV network applications supporting multimedia as well as mobile telephony systems. They significantly enhance CATV return path transmission capacities and provide a superior level of network service.

FU-436SDF-4M1B and 4M1C are distributed feedback optical laser modules featuring a built-in optical isolator. Without the need for cooling, OEMs are able to save on not only device costs but also on product

assembly time, with major savings on power consumption as well as being able to reduce end product design sizes.

The uncooled laser diodes operate at temperatures up to 85°C. They provide a stabilised power output over the entire temperature range, with a typical tracking error within 0.3dB. Operation is with low distortion, with second and third order figures less than -50dBC and -60dBC respectively. The designs also operate at low noise, typically less than -150dB/Hz, with a high differential efficiency of typically 0.2mW/mA.

With a central wavelength of 1290/1330nm, optical output power is typically 2.5mW with 4mW maximum.

For more information circle **276** on the reader service card or contact Mitsubishi Electric Australia, 348 Victoria Road, Rydalmere 2116.

First 0.25um CPLDS

AMD has claimed the industry's first 0.25-micron (Leff) process for CPLDs, a next-generation manufacturing process technology which is says will allow subsidiary Vantis to offer its customers higher performance, lower cost CPLDs. The electrically erasable process features three layers of metal and a core voltage of 3.3V. Vantis will roll out new devices from the MACH 4 and MACH 5 product families based on this 0.25um process, with the new devices to be known as the MACH 4A and MACH 5A series respectively.

MACH 4A couples high performance and

low cost with the ease-of-use of the existing MACH 4 product architecture. This product architecture provides many features to facilitate rapid development, including SpeedLocking, pinlocking through the use of input and output switch matrices, and flexible control logic. The MACH 4A family will consist of six devices ranging from 32 to 256 macrocells and 32 to 128 I/Os.

The existing MACH 5 product architecture has an innovative hierarchical switch matrix that allows designers to achieve high levels of integration and performance in a single device. The new MACH 5A products provide customers with additional performance in a family that has proved popular with designers because it provides the widest range of densities and I/Os available in the market. It will consist of 21 devices ranging from 128 macrocells to 512 macrocells and 74 to 256 I/Os.

The new parts are expected to provide significant speed performance increases. As an example, the M4-128A will be available in a 5ns speed grade, a 50% increase in performance. The M5-512A will provide guaranteed maximum propagation delays of 10ns, a 20% increase in performance.

For more information circle **278** on the reader service card or contact AMD Australia, Level 14, 33 Berry Street, North Sydney 2060. ❖

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Rain Brain Sprinkler Kits: Also 8 and 60 channel temp. monitors with PC Data logging. **Mantis Micro Products**, 38 Garnet Street. Niddrie, 3042. (03) 9331 4786, Fax (03) 9331 4782 http://www.home.aone.net.au/mantismp

Amidon Ferromagnetic Cores: For all RF applications. Send business size S.A.S.E. for data/price to RJ & US Imports, Box 431, Kiama NSW 2533. Agencies at Assoc TV Service, Hobart; Truscotts Electronic World, Melbourne and Mildura; Alpha Tango Products, Perth; Haven Electronics, Nowra; WIA Equipment Supplies, Adelaide.

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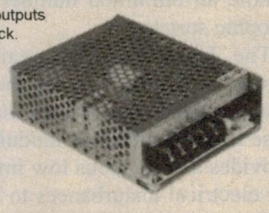

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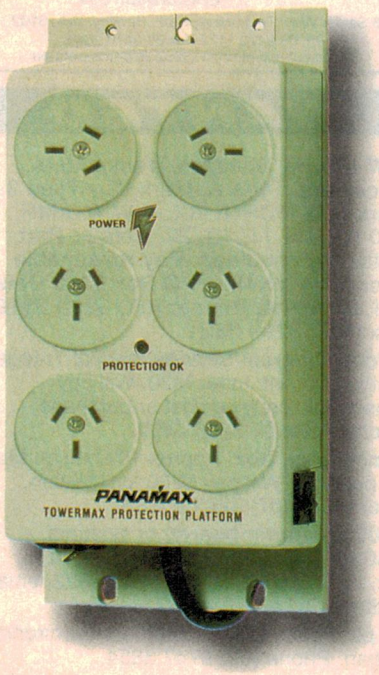
New Products

Surge Protectors

Eltek Pacific, Australian distributor of the award winning Panamax range of quality power protection equipment, has just released a new 240V Towermax KSU system for Australian conditions. The system is C-tick approved and provides complete protection for telephone key systems, small PBX's and mini computers against power and lightning related disturbances on the AC line and on all communications lines, using a combination of an AC base protector and signal modules.

The modular design of the system makes it possible to protect all incoming communication and power lines coming into the telephone or computer system, providing unprecedented protection against lightning damage. The new AC protector unit has a 700V clamping level and has the ability to handle an unlimited number of non-catastrophic surges.

The Towermax KSU maintains a true ground reference by using the Autoground strap, which is located on the back of the base unit and all of the modules. This strap provides a continuous low impedance path for electrical disturbances to be shunted to earth via the building ground.



The base AC protector has a thermal fuse to shut off power connected to the equipment in case of extended over voltage, a 10A circuit breaker and an on-off switch. A LED indicator shows when the unit is working,

The expected life of the product is calculated to be in excess of 377 years. So confident are Eltek in the reliability of the product that they have introduced a lifetime warranty: if the unit fails or should it be hit by lightning, the company will repair or replace the unit free of charge.

For more information circle **242** on the reader service card or contact Eltek Pacific, Unit 5/4 Prosperity Place, Warriewood 2102.

Low cost 'smart' cameras

A growing need for low-cost machine vision solutions has led to the addition of smart cameras to the range of devices available from machine vision specialist **Industrial Vision Solutions**. Auckland-based IVS has recently been appointed distributor for Vision Components GmbH, a German company which makes complete miniaturised industrial machine vision systems at a price comparable with conventional 'dumb' cameras.

The cameras are small and robust, and can be programmed by an external PC at the development stage — then unplugged for standalone operation in the factory. At $2000 - $5000, they are significantly cheaper than most conventional PC-based systems which can cost upwards of $20,000.

Features include an inbuilt video memory, image processor and industrial I/O, and they only require a DC supply voltage to operate. Several types of cameras are available including colour and high resolution models, with display being either on an external video monitor or a standard PC screen. A wide variety of application software packages is available for the cameras, providing contactless measurement, quality control, completeness checking, sorting, reading of bar and matrix codes, optical character recognition and self-learning systems.

For more information circle **241** on the reader service card or contact Industrial Vision Solutions, PO Box 31-310, Lower Hutt, New Zealand.

Capacitor mounts

Responding to a growing demand for added protection of discrete components and capacitors during assembly and for improvement in insulation from heat, **Bivar** has expanded its Discrete Component and Capacitor Mounts family. New styles and sizes are included, and a new line of mounts and insulators for electrolytic capacitors has been added.

Now available are four different styles of capacitor mounts for supporting moulded and conformal coated devices, elevating them from board surfaces for controlled positioning while preventing non-conducting solder joints and failure due to lead damage. Leads are spaced to industry-standard spacing for simplified board installation. Standoffs facilitate the removal of residual solder, flux or contaminants during board washing after assembly. The capacitor mount group is manufactrued from white, natural or black Nylon ASTM D 4066 PA111, UL rated 94V-2 material. Elevations range from 0.76 to 15.2mm.

The new ECM mounts and insulators for electrolytic capacitors are available for industry's most popular size components. A slotted cup design provides sidewalls that isolate and insulate the capacitor from surrounding components and circuitry, while enhancing ventilation. Available sizes range from type 5mm through to 35mm in 13 configurations. The ECM Series is made from the same material as

the capacitor mounts.

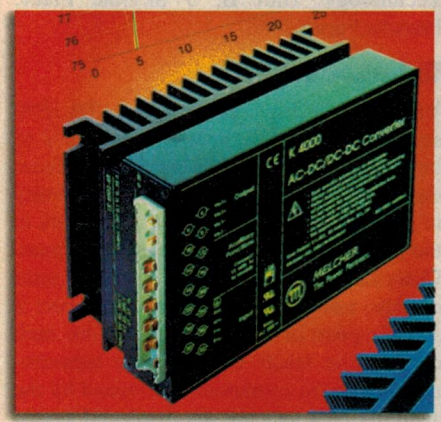
For more information circle **244** on the reader service card or contact M. Rutty & Co, 4 Beaumont Road, Mt Kuring-Gai 2080.

Converters use sync rectifiers

Melcher AC-DC converters of the K family feature high efficiency and output power through use of synchronous rectifiers, allowing for substantially reduced power losses without affecting the compactness of the units. The AC-DC converters feature an input power range of 85 - 255V AC and are suited to industry, railway and telecom applications.

AC-DC converters LK 4003-6R with PFC (power factor correction) feature an output current of up to 25A at 5.1V output voltage. The synchronous rectifier technology uses power FETs together with a sophisticated driver circuitry to replace conventional rectifier diodes. The forward resistance of the FETs is in the order of 5 to 10 times lower than with diodes.

For more information circle **245** on the reader service card or contact Scientific Devices Australia, 118 Atkinson Street, Oakleigh 3166.



Non-Toxic cleaning solvent

Electronic Cleaning Solvent No.1 (ECS) is a premium quality fast drying non-toxic solvent of high priority for use on delicate electronic, electrical and precision mechanical assemblies. Formulated in Australia for local conditions and requirements, it is a quality degreaser also.

The solvent is available in 175gm (250ml) non CFC aerosol and also in bulk sizes from 1 litre to 20 litres.

For more information circle **246** on the reader service card or contact Richard Foot Pty Ltd, 14/2 Apollo Street, Warriewood 2102. ❖

The Latest Test & Measuring Instruments

Recorders offer harmonic analysis, RMS

Yokogawa's new enhanced OR300 series Oscillographic Recorders provide sophisticated functions for monitoring power supply quality. Harmonic analysis and real-time RMS measurements allow the measurement of power supply waveforms containing harmonic components, harmonic currents in commercial supply systems and analyses up to the 40th harmonic. Users can select from RMS value, content, phase angle and active power, power content, power phase angle, etc for each order of harmonic.

The OR300 recorders have four-channel isolated analog inputs so the channels can be used in parallel and harmonic analysis performed separately on the data from each channel by switching the display between channels. Three-phase currents can be measured simultaneously and harmonic components superimposed on each phase can be measured with a single instrument.

The results of harmonic analysis can be saved on a flash ATA memory card and processed using MS Excel, Lotus 1-2-3 or other commercial spreadsheet software. Continuous (trend) data saving of the analysis results is also possible, so that variations in a pre-selected parameter during a certain period can be monitored.

Data can be also be transferred online to a personal computer, via the recorder's RS232 port. By employing a fax/modem card installed in the OR300's card slot, The recorder can even be remotely operated from a PC over a telephone circuit, allowing the user to change measurement range, trigger level, etc.

Housed in a slim, light body, the OR300 series recorder can be powered from the mains, rechargeable batteries, a DC converter for operation from a car battery, or dry cells.

For more information circle **201** on the reader service card or contact Yokogawa Australia, 25-27 Paul Street North, North Ryde 2113.

DTMF option for audio analyser

German manufacturer **Neutrik Cortex Instruments** has released a DTMF analyser retrofit for its RT-1M 'Rapid-Test' multitone audio analyser.

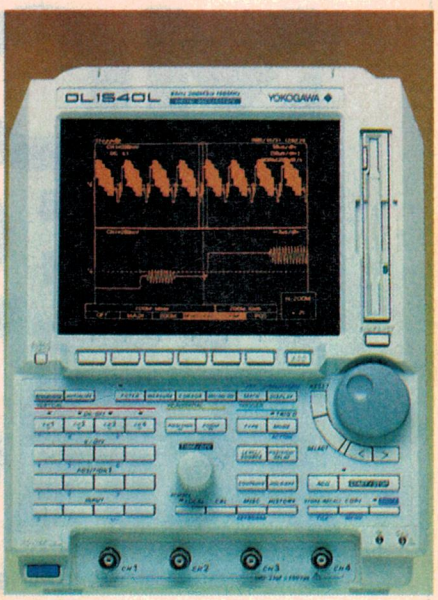
With its advanced, state-of-the-art design, the RT-1M Rapid-Test is capable of simultaneous two-channel signal measurement and complex analysis functions. The system employs multitone technology to simultaneously transmit all signal test frequencies in a multitone burst and subsequently analyses the test results in an advanced, DSP-based environment using FFT techniques. Depending on the application, the RT-1M is claimed to improve test times by a magnitude of 3 to 100.

The new DTMF option monitors the analyser input for the DTMF-specific combinations of two frequencies and checks if they are within the standard. The interpreted key code is stored in the analyser's internal buffer. Detection time is typically 50ms, with another 50ms minimum pause between two keys. This allows an entire keypad to be tested in under two seconds, including verification of the DTMF code by the IEEE-488 controller.

For further information circle **202** on the reader service card or contact Amber Technology, Unit B, 5 Skyline Place, Frenchs Forest 2086.

Enhanced DSOs

Yokogawa's high performance DL1500 series DSOs feature new enhancements to improve useability. Additional cursor functions have been added, including the ability to perform high-resolution measurements in the time axis and direct readout in degrees. Users can set cursors anywhere on the main display, using a zoom window to select a specific point in the waveform data for each cursor. The result is delta time measurements with the resolution determined by the acquired data and not the displayed screen data. The acquired data resolution is determined by the sampling speed.



Another new function is the ability to automatically measure the time span of a burst signal. A typical application for this feature is the determination of tracking error on various types of optical disk drives.

For more information circle **203** on the reader service card or contact Yokogawa Australia, 25-27 Paul Street North, North Ryde 2113.

Handheld 2GHz spectrum analyser

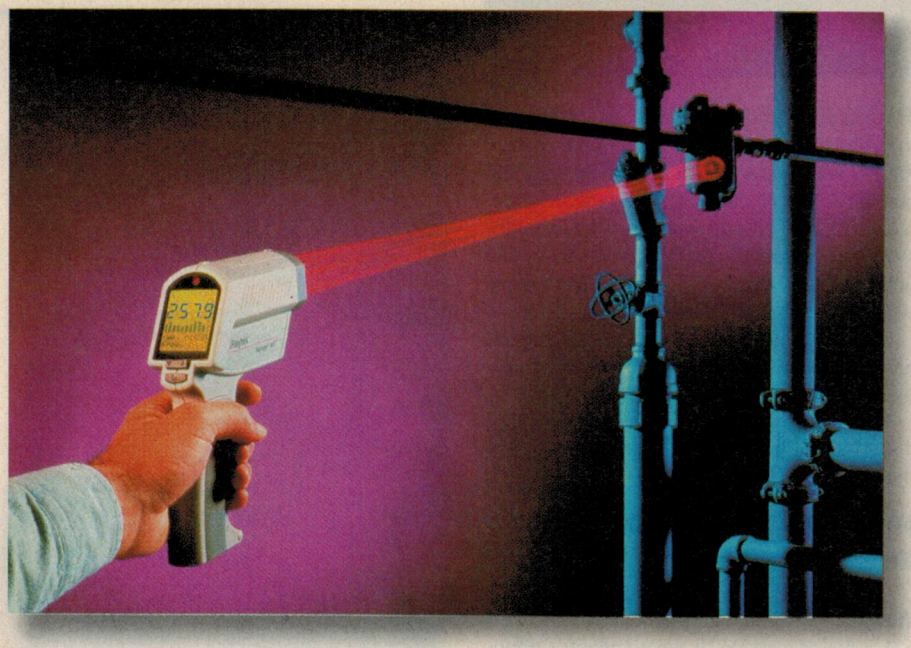
The **Protek** TE-3201 is a compact RF Field Strength and Spectrum Analyzer designed for on-site testing, installing and maintenance of mobile telecommunications systems, cellular phones, cordless phones, CB radios, paging systems, cable TV and satellite receiving equipment, and also installing and measuring antennas. It provides wideband reception from 100kHz to 2060MHz, has a frequency measurement accuracy of +/-25ppm and level measurement accuracy of +/-3dB.

Certified to ISO 9001, the TE-3201 has measurement modes covering narrow band and wideband FM, AM and SSB signals. It can display up to 160 channels on the inbuilt 192 x 192 pixel backlit LCD display, and provides a range of display options as appropriate for the various measurement modes.

Other features include an RS-232C serial port for connection to a PC, a parallel port for direct connection to a printer, an inbuilt 120mW audio amplifier and 8Ω speaker for sound monitoring, a 10-setup configuration memory as well as a 10-display data memory, selectable manual/memory (channel)/search scanning and a programmable power-off function. Power is from six AA NiCad cells, with an external charger supplied as standard.

The unit also comes with Windows 95 software which lets you graphically display the signals, as well as log the dB level of each hit. The kit comes complete with a padded carry case, operations manual, software manual, DB-9 data cable, 50Ω coax cable with BNC connectors, loaded antenna, 12V DC lighter plug, six rechargeable NiCad batteries, and combination wall charger/battery eliminator.

For more information circle **204** on the reader service card or contact Clarke & Severn Electronics, Unit 4/8A Kookaburra Road, Hornsby Heights 2077.



IR thermometers have laser aiming

A new generation of portable IR thermometers from **Raytek Corporation** makes critical temperature measurements more reliable by defining the target area with a 16-point laser sighting circle. Precise aiming, combined with enhanced electronic data storage and emissivity reference tables, improve the speed and accuracy of temperature measurements in a broad spectrum of process and maintenance applications throughout industry and institutions.

The new Raynger MX instruments are claimed to be the only portable IR thermometers on the market with a laser circle that defines the target spot size and centre at any measurement distance. Other advances include on-board emissivity references and temperature logging, a bar graph display of the last 10 readings and contact probe inputs.

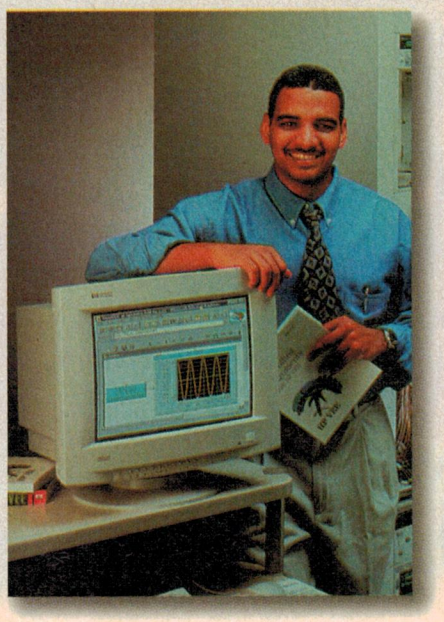
The three models comprising the battery powered MX Series have a measuring range of -30 to 900°C, and a 60:1 distance to target area ratio.

The MX2 is intended to meet basic temperature measuring needs, while the MX4 adds storage for 100 readings, scrollable emissivity data, and an RS-232 digital output for computer communication. The MX4+ version also includes Windows compatible graphing software, a line voltage power supply, a Type K thermocouple probe and an RS-232 computer cable.

Options include a portable thermal printer, thermistor (NTC) probe and a calibration certificate.

For more information contact Raytek Corporation, PO Box 1820, Santa Cruz, CA 95061-1820, USA.

HP's VEE 5.0 adds ActiveX, FireWire support



Hewlett-Packard has announced HP VEE 5.0, a major revision of the company's popular visual programming language for test-program development in manufacturing test, design characterization and verification, and data-acquisition applications. HP VEE 5.0 programs can now use Microsoft's ActiveX Controls and can control other ActiveX Automation applications. In addition, VEE 5.0's new Web-monitoring capabilities enable engineers to implement measurement systems that can be accessed and controlled remotely.

HP VEE 5.0 can load and operate any ActiveX control. For example, users now can add to HP VEE such ActiveX controls as bar-code readers; file encryption and compression; databases; scientific functions; project-management utilities; application- and program-version control; high-speed graphics; calendars; and a wide variety of buttons, knobs and other graphical user-interface objects.

Within an HP VEE 5.0 program, users can control any application that exposes ActiveX objects. Users can send data automatically to a Microsoft Excel spreadsheet for further analysis, or to a Microsoft Word file for inclusion in a report. HP VEE 5.0 programs can send and retrieve data from Microsoft Access and can automatically send electronic mail via Microsoft Outlook when specified events occur.

HP VEE 5.0 includes a built-in Web server that allows users to monitor a HP VEE program remotely using standard HTTP protocol. Test-program developers can make any HP VEE panel accessible over the Web.

HP VEE 5.0 also supports the IEEE-1394 (FireWire) high-speed interconnect for VXI in addition to GPIB, VXIbus, RS-232, PC-plug-in, GPIO and LAN-based interfaces.

Free evaluation copies of HP VEE 5.0 — as well as a variety of application notes, instrument drivers, user tips, case studies and other HP VEE technical information — are available for downloading from the Internet (http://www.hp.com/go/hpvee). HP VEE 5.0 is also available in Australia from Total Turnkey Solutions on (02) 9979-5643. ❖

Electrician's Clamp Meter from DSE

Dick Smith Electronics has recently added an attractively priced clamp meter to its range of digital multimeters, with ranges which should make it of interest to electricians and technicians working with high-current equipment.

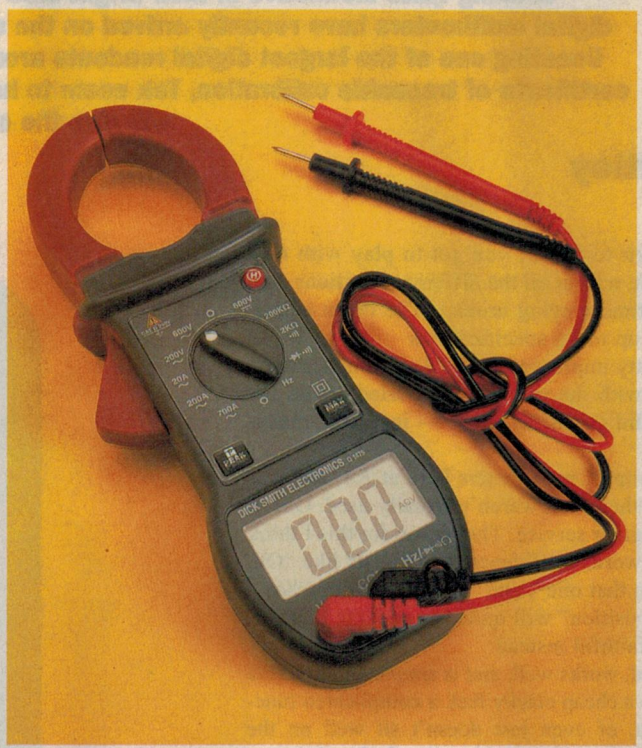
by Jim Rowe

CLAMP METERS provide a convenient way of quickly measuring the current in conductors — especially when they're carrying significant AC. The iron laminations inside the 'jaws' form the core of a simple current transformer when the jaws are closed around a conductor, with the conductor itself forming a single-turn 'primary' and a winding inside the meter itself (or sometimes a Hall-effect sensor) as the 'secondary'. This makes them fairly popular with electricians, as they allow currents to be measured in high-voltage circuits without having to 'break' them for inserting a measurement shunt.

There's quite an art to making a good clamp meter, though. The jaws have to mate reliably and consistently, so any air-gap formed in the magnetic 'circuit' is both very small and consistent — otherwise the reading accuracy will vary quite badly. So good clamp meters have to be well made, and tend to be pretty expensive. That's why a reasonably priced clamp meter with respectable performance specs is worth knowing about.

Dick Smith Electronics has recently added such a meter to its range — the Q-1475. Made in Taiwan, it offers a selection of measurement modes and ranges which should make it of considerable interest to anyone who needs to measure reasonably heavy currents in circuits carrying up to 600V.

The basic meter is a 3.5-digit DMM with a maximum reading of 1999 and easy-to-read digits 20mm high. There are three AC current ranges, with full-scale readings of 20A, 200A and 700A respectively. In addition, the meter has two AC voltage ranges (200V and 600V), a DC voltage range (600V), two resistance ranges (2kΩ and 20kΩ), a continuity/diode test range and an auto-ranging frequency measurement function which measures to 20kHz.



Rated accuracy on the various ranges is quite respectable. The basic digital voltmeter (i.e., the 600V DC range) is rated at +/-(0.5% + 1 digit), which broadens to +/-(1.2% + 4 digits) on the AC voltage ranges (50 - 500Hz) and +/-(1.2% + 1 digit) on the resistance ranges. The AC current ranges are all rated at +/-(1.5% + 4 digits) for 50/60Hz, or +/-(3.5% + 5 digits) for the frequency range 40 - 500Hz, suggesting that the clamp system doesn't degrade the performance by much. For frequency measurement the meter is rated at +/-(0.1% + 3 digits).

Input impedance for voltage measurements is 10MΩ, with overload protection to 600V DC or AC (RMS). Other features include buttons for reading hold, maximum hold and peak hold. Power comes from a 9V battery, which mounts in a compartment at the rear of the LCD display.

The meter is rated to comply with IEC1010 - 1 mains over-voltage category II pollution degree II, for 240V AC mains work. This means that it should be suitable for most general electrical work, although the user information that comes with the meter suggests that it's not recommended for high voltage industrial use — i.e., high energy circuits above 250V DC or AC.

The Q-1475 is supplied complete with leather carrying case and strap, test leads, battery (fitted) and user guide sheet.

Trying it out

We checked a sample of the Q-1475 against our reference instruments, using a test loop for the current clamp ranges. Basically the meter gave a very creditable account of itself, with readings that were comfortably within specs on all of the ranges we could test. We even discovered that it measures frequency well beyond the rated 20kHz — to over 100kHz, in fact.

Overall, then, our impressions are that the Q-1475 is a solidly made meter which should be very suitable for general electrical testing work. At the quoted price of $149 it seems good value for money. ❖

DSE Q-1475 Clamp Meter

A competitively priced 3.5-digit DMM with current clamp, suitable for general electrical testing.

Good points: Rugged construction, measures to 600V AC and DC, plus AC current to 700A. Also measures resistance, continuity and frequency.

Bad points: Not much, although a few more voltage ranges would enhance its flexibility and expand its potential uses.

RRP: $149

Available: Dick Smith Electronics stores and dealers.

Tek's new TX series of DMMs

Looking quite distinctive in their bright blue holsters, Tektronix' new TX1 and TX3 digital multimeters have recently arrived on the scene — and very good they are too. Boasting one of the largest digital readouts around, and supplied as standard with a certificate of traceable calibration, Tek seem to have come up with a DMM that I think will give the opposition a real run for their money.

by Graham Cattley

I LIKE reviewing modern test gear; you get to play with nice pieces of new equipment, try out all the different functions, and generally have a good time playing around. The down side is that it all invariably lives up to its specifications — so what can you write about? I was pretty impressed with a Tek demonstration of the TX3, which ended with the meter being hurled across the room (it survived); but it did get me thinking — just what makes a good multimeter?

I just did a quick round-up of multimeters here at *EA*, and was surprised at the number of them that weren't actually used. Out of the lot, only two were in regular service. The reason for this I think can be summed up in one word: confidence. Comments like "Oh, I think the fuse has gone in that one", and "careful, that one has a dodgy switch in the volts position" will quickly condemn a meter, and you'll go and use old faithful instead.

If the meter is easy to read, works well, and is simple and intuitive to operate, it's 'in'. If it has a cheap clacky feel, a complicated function/range selection system, or even just doesn't sit well on the bench, you lose confidence in it and it joins the pile of other dropouts on the shelf.

As you might have guessed, the Tektronix TX3 that we had for review definitely fell into the first category — it was solid, well built and had one of the largest LCD screens we've seen in a digital multimeter. It came with an ISO9001 Certificate of Traceable Calibration that is valid for a period of one year, and was also 1000V-CAT III and IEC 61010-1 compliant. More than that though, it *felt* right. You trusted the readings, it didn't turn itself off in the middle of the measurement, it sat up well on its tilt bail and generally behaved itself.

But enough of this subjective view — let's have a look at some of the specs.

Claim to fame

THE TEKTRONIX TX3 DMM is a 4-4/5 and 3-4/5 digit (50,000/5000 count) meter with an update rate of four times a second. (As well, there's a 20-segment bar graph display that's updated 20 times a second...)

The TX3's main claim to fame is that it is a true RMS meter using something that Tek calls 'Digital RMS technology'. Conventional RMS measurements are performed with A/Ds and analog multipliers, which lose accuracy at low signal levels and are non-linear at high frequencies. Instead, Tek uses a Sigma-Delta converter for ADC linearity, and then continually processes the input data stream through a DSP so that an integral number of cycles isn't required.

According to Tek, this new technology allows accurate measurements of AC, AC with a DC offset, and AC+DC voltages with an 'instantaneous' settling time. The settling time is actually more along the lines of one second, but it's impressive none the less.

The meter's DC accuracy in voltage measurements is a very respectable +/-(0.05% + 1 count), while the AC accuracy runs at a slightly lower +/-(0.4% + 2 counts) over the 500mV to 1000V range.

Current measurements are accurate to +/-(0.2% + 2 counts) for DC, and +/-(0.6% + 2 counts) for AC. It can handle a maximum of 10A for three minutes, and has a resolution of 10nA on the 500uA scale.

The resistance ranges cover 50MΩ down to 50Ω, with automatic test lead compensation on the lowest range and an accuracy of +/-(0.1% + 2 counts).

Other ranges include frequency measurements from 0.5Hz to 1MHz with up to 0.001Hz resolution, capacitance from 5nF to 50mF at around +/-(1% + 3 counts), and temperature from -50° to +980°C with the (supplied) K-type thermocouple.

OK, enough of the specs, let's move onto the features. Perhaps two of these stand out right away: the dual numeric displays and the backlight. As you can see in the photo, the secondary smaller readout offers extra information on the measurement being performed. For example, when taking AC voltage measurements, the secondary display gives you the frequency of the waveform, or with frequency measurements it can display either the duty cycle or the edge trigger polarity.

The backlight is simply a row of six green LEDs situated along the left hand edge of the display, and while not as startling as an electroluminescent panel, they illuminate the screen more than enough to read the display in low lighting.

Other features

OTHER MORE subtle (but no less important) features include time stamps on min/max measurements, a very flexible delta function that allows you to easily monitor changes in measurements, and 4-20mA process control loop measurements giving a dual readout of milliamps and percent full scale.

There are 30 memory locations in the TX3 (which are retained when the power is turned off), and a comprehensive configuration screen that allows you to set such basic settings as reference values for dB measurements, key-beep and auto power off delay.

One other nice point is that the batteries (two AA cells) can be easily replaced without having to open the unit and break the calibration seal. This saves the hassle of having the meter re-calibrated every time the batteries are changed. You have to break the seal to change the main fuse though, as it is situated inside the case (it has to be, as it forms a part of the current measuring circuit). And speaking of current measurements, they are taken from a single 'current' socket on the meter — i.e. there isn't a separate 10A input socket to introduce lead changing hassles.

Along with the TX3 you get the distinctive bright blue rubber holster, a test lead set rated to 1000V-CAT III and supplied with push-on alligator clips, a K-type bead thermocouple and plug adapter, a (quite lucid) user manual and crib sheet, and of course, its certificate of traceable calibration.

There is also a WSTRM PC interface package available that sets up a virtual TX3 DMM on your computer. It comes with an optical interface cable, Win95/NT drivers and WaveStar for Meters data acquisition and data logging software as well. This optional accessory pack didn't arrive in time for this review, but looks to be quite straightforward to drive.

The only drawbacks that I could see with the TX3 was that it is a little on the heavy side (550g including holster), and that unless you nail it down it's going to end up on someone else's bench... It is also a bit pricey at around $785, but when you look at other top-end DMMs I think you'll find that the TX3 compares more than favourably. ❖

Tektronix TX3 True RMS DMM

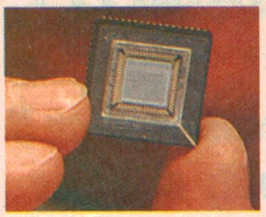
A high-end handheld DMM with fast and accurate DSP-based true RMS capability.

Good points: Comes with a certificate of traceable calibration, has a huge LCD dual readout and backlight.

Bad points: That quality and performance doesn't come cheap...

RRP: $784.46. (inc. 22% sales tax)

Available: All Tektronix authorised distributors, or call Tektronix on (02) 888 7066.



Silicon Valley Newsletter

Japan moves DRAM production overseas

IN AN EFFORT to reduce capital expenditures and labour costs, Fujitsu and Hitachi, two of Japan's top DRAM producers, are exporting production of some 256-megabit DRAM chips overseas.

Fujitsu will use its new Oregon (USA) plant to produce the next-generation memory circuits. The company expects mass production of the new chips at the Oregon facility to commence in early 2001. Hitachi will concentrate its DRAM production at a Singapore facility.

Overall, Japanese capital expenditures for ICs are continuing to fall rapidly. The top five Japanese IC producers (Hitachi, Fujitsu, NEC, Toshiba and Mitsubishi) collectively plan to spend only US$3.5 billion on new plants and tools in the current fiscal year, which ends in March of next year.

Meanwhile, Intel is reportedly negotiating with Korea's Hyundai to acquire or resurrect a major new DRAM facility the Japanese company has been building in Fife, Scotland. The project was abandoned earlier this year as Hyundai reeled from the fall-out of the economic crisis in the country's economy.

Reportedly the two companies are considering setting up a US$1.14 billion joint venture. Hyundai has confirmed the negotiations, but Intel has declined to comment.

Seagate shock: Alan Shugart fired

IN A STUNNING move, Alan Shugart, one of the icons of Silicon Valley's high-tech industry and one of its most respected business managers, was fired as chairman and chief executive officer of Seagate, the Scotts Valley disk drive market leader he founded some 15 years ago. Seagate's board of directors appointed Stephen Luczo, 41, to replace Shugart.

Luzco had been president of the company since last September. He joined Seagate in 1993 and was widely regarded as Shugart's hand-picked successor.

Shugart built Seagate from scratch into the world's leading disk drive producer. He recently formulated a blueprint for the company to recover from its current problems and resume a path of strong growth. Ironically, Seagate's board announced that it intends the company to follow Shugart's recovery plan, but directors felt Shugart was not moving fast enough.

"I had no idea this was coming", said Shugart, who started working on storage technology at IBM in 1959. "I'm shocked. When I tried to determine the reason why the board was taking this action, I was told they wanted to increase the pace and that I wouldn't resign."

Chip production breakthrough by IBM

NEW CHIP-MAKING technology that increases IC performance and lowers chip cost? Not exactly a headline-grabbing development after 30 years of Moore's law. But at a time when chipmakers routinely pack transistors so close together you can fit 400 next to each other on the width of a hair, increasing chip performance 35% while reducing cost 33% is still a major development. That's what IBM claims to have achieved with the new 'silicon-on-insulator' technology it has been working on for the past 15 years.

The SOI process deposits a layer of insulating material on the surface of a silicon wafer before adding the layers used to form the transistors, offering improved insulation and lower bulk capacitance, and thus allowing the transistors to be placed ever closer together. IBM estimates the new technology will increase the speed of existing ICs by 35%, while reducing overall production cost by a third.

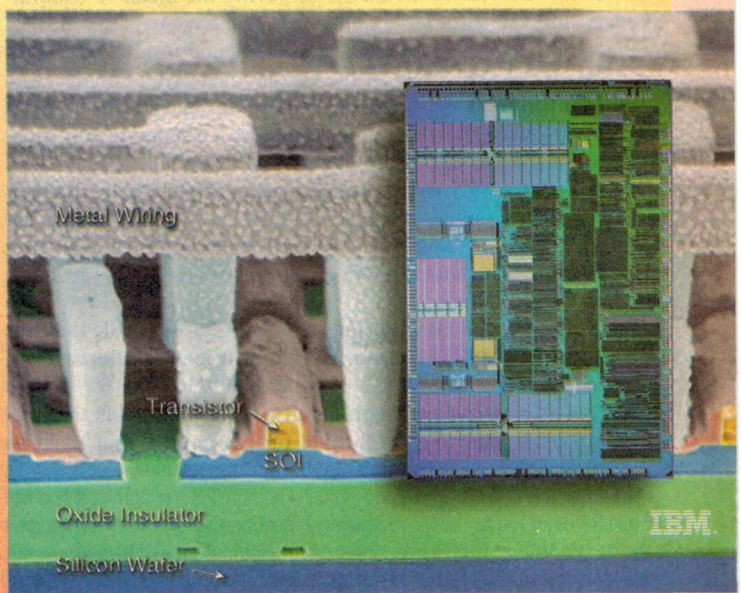
The new process was developed with the aide of special new wafer processing equipment from Ibis Technology of Danvers, Massachusetts.

IBM researchers have been working on the SOI technology for 15 years. Combined with its recently developed copper interconnect technology, IBM will be able to vastly increase the performance of its curent generation of ICs at only a small additional cost.

"IBM is well in advance of most with the technology", said Fred Zieber, an analyst with Pathfinder Research. "In the long run, this is pretty important. You need some things to keep advancing the technologies of silicon."

"They've always been a technology leader, and this is the first fruit from a 15-year effort", said analyst Bryan Lewis, principal semiconductor analyst at Dataquest in San Jose.

IBM is now testing the new process at its East Fishkill, New York, chip facilities and expects to have the process in volume production applications in the first half of next year at a facility in Burlington, Vermont. IBM plans to use chips with the SOI technology it its System 390 mainframes, AS/400 minicomputers and RS/6000 servers.



"We believe SOI, with its high-performance and low-power characteristics, is a significant breakthrough in chip technology", said IBM microelectronics division GM Mike Attardo. "Like our copper chips, SOI will accelerate the industry's constant drive to create smaller, more powerful, less expensive electronic goods."

Shugart was part of the IBM team that pioneered the original Winchester disk drive in the late 1960s. He left IBM in the early 1970s to found Shugart Associates. After selling the company to Xerox, he founded Seagate.

IBM & Sanyo sign consumer IC pact

SANYO ELECTRIC, the Japanese producer of electronic components and audiovisual equipment, has announced a five-year strategic alliance with IBM to jointly develop and produce ICs for use in consumer products, including TVs, mobile phones, personal digital assistants, DVD players and still cameras. The agreement gives Sanyo access to IBM's Blue Logic custom microchip technology.

The deal is expected to significantly boost IBM's share of the lucrative market for non-memory ICs in Japan. "We think the market for microchips for use in digital household information products will exceed the market for chips for personal computers", said Sanyo President Sadao Kondo. "Both our companies agreed on the need to be ready for that."

"We think we can help each other", added Michael Attardo, GM of IBM Japan.

The ICs to be developed will be produced by IBM using the company's state-of-the-art 0.18 micron process technology. With most competing Japanese IC makers using 0.35 and 0.25um process technologies, Sanyo believes it will have a significant advantage.

"Sanyo doesn't have production lines even with 0.25um technology, so we'll be consigning all such production to IBM. It would be a huge investment for us to set up these kinds of lines on our own", said Sadao.

AMD gets Motorola's copper technology

IN ITS STRUGGLE to keep up with Intel in the battle for microprocessor performance and marketshare, Advanced Micro Devices has announced a key strategic alliance with Motorola that will give AMD access to Motorola's advanced copper-based interconnect production technology. Copper interconnects promise to significantly boost IC performance while lowering overall production cost and power consumption.

AMD is among a slew of major IC makers rushing to adopt copper interconnect technology, whose first commercially viable application was announced only a year ago by IBM.

Under the terms of the AMD-Motorola pact, AMD will share its manufacturing process for making 'flash' memory chips, an area where AMD has been a market leader. Flash chips, which maintain data while power is turned off, are used commonly in digital cameras and cellular phones. Motorola plans to use AMD's technology to help it integrate flash memory chips into single chips that control entire systems.

For AMD, the access to Motorola's processing technology represents a highly valuable short-cut to a new level of processing capability that will ensure AMD will be able to boost the performance of its K6 and future K7 processors while remaining price competitive with Intel. AMD officials think they will be able to start producing copper-based versions of its processors as early as late this year, with commercial availability in PCs late in the first half of 1999.

TI hurt by chip slump

TEXAS INSTRUMENTS' profits have dropped to just US$43 million, an 83% plunge from a year ago. Depressed IC prices, especially in the memory market, is heavily impacting TI's overall profitability. Without a charge of US$233 million to cover the cost of restructuring its chip and other operations, TI would have reported a 12% gain from the $249 million it earned a year ago.

Included in the one-time charge were losses due to the sale of its memory chip business to Micron Technology and the elimination of 3500 employees through layoffs and attrition.

TI's results did include a gain of $83 million from the sale of its joint Acer DRAM venture to Acer. However its sales declined to US$2.2 billion from $2.6 billion.

On the positive side, TI said demand for the company's line of digital signal processors continued to show healthy gains.

Ascend buying Stratus for US$822 million

IN ANOTHER major Silicon Valley telecommunications merger, Ascend Communications announced it will buy Stratus for US$822 million, creating a powerful supplier of integrated multimedia Internet telecommunications equipment.

Ascend makes data communication switches and Internet access equipment, while Stratus computers control key functions at the heart of much of the telephone network. The two firms will develop new integrated voice and data network products combining voice, data and video. In the assimilation process, Stratus computers will act as the link between incompatible circuit-switched voice networks and data networks that communicate on different, but more efficient, Internet standards, Ascend officials said.

"We are going to be able to bridge the voice network and the Internet network", said Ascend's CEO Mory Ejabat.

The market for combined voice and data network systems will give Ascend the lead in a market that is expected to grow to US$10 billion over the next couple of years. The new company will compete with other suppliers such as Lucent Technologies and Northern Telecom. Ascend said it will divest those Stratus operations that supply computer systems to banks, brokerages and other corporate clients. ❖

Dell & Compaq both top

FEW PEOPLE would have imagined any PC vendor to catch up with Compaq, let alone a company which sells most of its products outside the traditional sales channels. But International Data Corp and Dataquest have released figures that show Dell Computer sharing the top PC vendor position in the US market with mighty Compaq. And if it hadn't been for the PC business Compaq acquired with the purchase of Digital Equipment, Dell would have been alone on top.

In another shocker, IBM has fallen out of the Big Five for the first time since it entered the PC field in the early 1980s. The others in the top five US personal computer vendors were Hewlett-Packard, Gateway and Packard Bell NEC, each of which had almost identical market shares at around 7.7%.

Dell's marketshare in the US moved upward from just 9.1% in the second quarter a year ago to 14.3% in 1998, the same as Compaq's share. The company shipped a whopping 1.1 million systems in the quarter, up 70% from a year ago.

Worldwide, 21 million computer units were shipped in the second quarter, up 13.9% from the 1997 second quarter. Compaq remained the top vendor, while Dell and IBM ranked second and third respectively. US PC shipments were about 40% of the world's total.

Apple has sizzling Q3

WHAT A DIFFERENCE a year makes! Apple Computer, brimming with new confidence and optimism and strong demand for its portfolio of new products, has reported a US$101 million third quarter profit, its third in a row and more than double the preceding quarter's earnings. The profit also compares to a US$56 million loss a year ago. Revenues remained stable at $1.4 billion.

Steve Jobs, Apple's co-founder and interim CEO who is leading the remarkable turnaround, said the positive results are due to record sales of high-end Macintosh G3 computers and the popularity of new PowerBook laptop computers. "Apple had a terrific quarter. We sold a record number of Power Macintosh G3 computers, customers love our new PowerBooks, Apple earned its highest profits in years, and we ended the quarter with the lowest inventory level among the major PC players", said Jobs.

Computer

News & New Products

Smallest-yet bubblejet printer

Canon claims its new BJC-50 is the world's smallest portable colour printer with optional full colour scanning capabilities. With all the features and performance of a desktop printer but weighing only 900g, the BJC-50 is described as the perfect travelling companion — delivering Canon's Drop Modulation Technology and Image Optimiser technology.

Measuring just 302 x 112.5 x 49mm including the built-in rechargeable battery, the BJC-50 prints up to 5.52 pages per minute in monochrome and 2.1ppm in colour, a performance rivalling full-sized desktop units. Small and lightweight, the BJC-50's battery prints up to 100 A4 pages per charge, making it ideal for users on the move.

User convenience is boosted with an Infrared (IrDA) interface built into the printer, allowing documents from an IrDA equipped Windows 95/98 notebook or desktop computer to be sent directly to the printer without the need for cables.

Transforming the BJC-50 into a scanner is as simple as replacing the cartridge. The optional Colour Image Scanner Cartridge (RRP $149) is substituted for the ink cartridge and enables colour scanning up to 360dpi.

Included as standard with the BJC-50 is a black ink cartridge; colour ink cartridge; ink cartridge storage container; Lithium Ion battery; a universal AC adapter; and Image Optimiser-enhanced printer drivers for Windows 3.1/95.

The BJC-50 has an RRP of $699 including tax, and is available from Canon dealers and selected retail stores. For more information circle **160** on the reader service card or contact Canon Australia, 1 Thomas Holt Drive, North Ryde 2113.

CD-R duplicator

Otari has added the CDP-50 CD-R Duplication System to its extensive range of industrial tape duplication products. The compact desktop system is supplied complete with pre-installed CD-R duplication software, requiring only the addition of a standard PC-compatible keyboard, mouse and VGA monitor to form a cost-effective package capable of duplicating up to 50 CD-R discs continuously and automatically.

Simplicity of operation is a key feature of the CDP-50. Before the duplication process begins, data from the Master Disc is read at 12X normal speed and downloaded into an internal hard disk drive. Once this process is completed. the CDP-50 automatically begins duplication onto the required number of blank discs at a 4X copy rate. A built-in SCSI port also allows easy expansion of the CDP-50 by the connection of external SCSI devices.

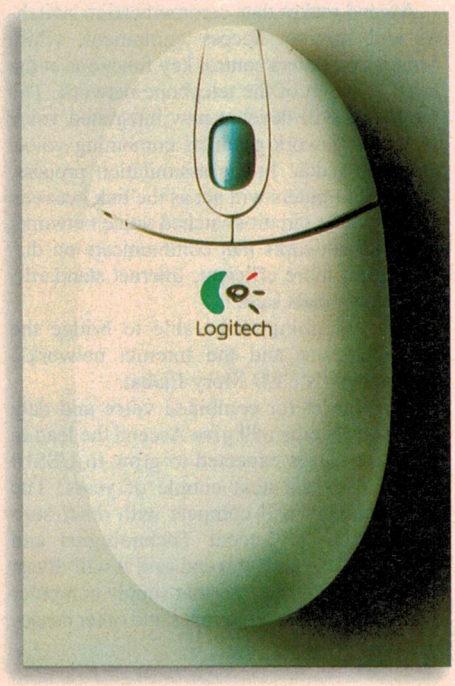
Otari claims that the new CDP-50 offers the ideal solution for the increasing number of customers requiring an affordable, smaller run system capable of supporting various Master Disc formats such as CD-DA, CD-ROM, Video CD and CD Extra.

For more information circle **161** on the reader service card or contact Amber Technology, Unit B, 5 Skyline Place, Frenchs Forest 2086.

Cordless wheel mouse

Logitech Australia has released a premium wheel-enhanced cordless mouse featuring a two-button plus wheel design, radio technology and Logitech's MouseWare 8.0 software.

Available from Logitech dealers and distributors at an RRP of $139, Cordless Wheel Mouse offers a cordless, ambidextrous alternative to users looking for easy screen navigation in all popular applications — plus the increased productivity afforded by Logitech's programmable buttons. The innovative scroll wheel allows easy scrolling in all Windows 95/98, Windows NT 4.0 and Internet applications.

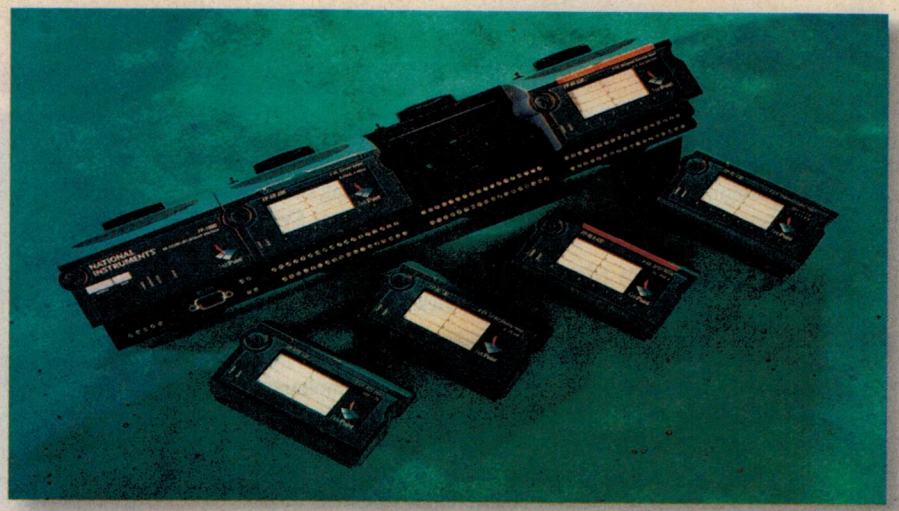


The product includes two units: a newly designed cordless mouse, which uses two standard alkaline AAA batteries, and a compact receiver with included adaptor that plugs into any serial or mouse port. The advantages of such radio-based products include responsiveness, long battery life and the ability to operate without the line-of-sight requirements inherent in competing devices relying on infrared signal transmission.

System requirements for Cordless Wheel Mouse include an IBM or compatible, Microsoft Windows 95/98 or Windows NT for scrolling/zooming and an available serial or mouse port. Under Windows 3.1, the product will function as a standard three-button mouse.

For more information circle **162** on the reader service card or contact Logitech Australia, Level 2/633 Pittwater Road, Dee Why 2099.

Distributed I/O System for industry



National Instruments has announced five new modules for its FieldPoint system — an intelligent, distributed and modular I/O system that gives industrial system developers an economical solution for monitoring and control applications.

The new modules deliver direct thermocouple and resistance temperature detector (RTD) inputs, 12-bit inputs, relays, and low cost digital inputs. All are isolated and software programmable, and feature HotPnP plug and play operation for easy installation and configuration. FieldPoint includes an OPC server and is compatible with a wide range of industry software packages, including National Instruments' BridgeVIEW, Lookout, and LabVIEW application software products.

The new FP-TC-120 module accepts eight thermocouple or millivolt inputs. It is compatible with all popular thermocouple types, including J, K, T, R, S, and N, and automatically performs cold-junction compensation, linearisation, and open thermocouple detection. The FP-RTD-122 accepts eight three-wire RTD inputs. It also automatically performs linearisation and scaling for accurate measurements with RTDs.

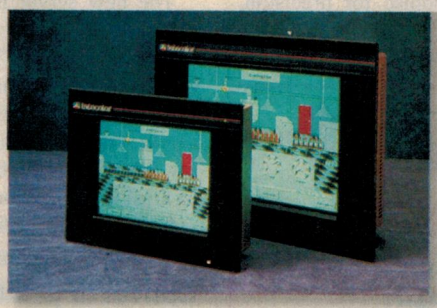
The FP-AI-100 accepts eight analog millivolt, volt, or milliamp inputs, and handles voltages up to 36V. The FP-RLY-420 features eight electromechanical relays for flexible load and switching applications. The FP-DI-300 accepts eight 24V DC discrete inputs.

For more information circle **163** on the reader service card or contact National Instruments Australia, PO Box 466, Ringwood 3134.

Flat panel displays

Intelligent Systems Australia has announced their new line of Intecolor Industrial Flat Panel Displays. The new flat panels are offered in a full range of sizes from 10.4" to 20.1", and are less than 4.5" deep. Screen resolutions range from 640 x 480 to 1280 x 1024. Rated NEMA 4/12, the flat panels are ideal for tight spaces and mobile units where touchscreen control and rugged performance are critical.

Features include AC or DC operation, cus-



tom options, a touchscreen option, analog video inputs (HD-15), and a proprietary luminance control (front panel) which provides 100:1 range with no colour shift. And like every Intecolor product, the panels are built-to-order according to Intecolor's Guardian System Design criteria.

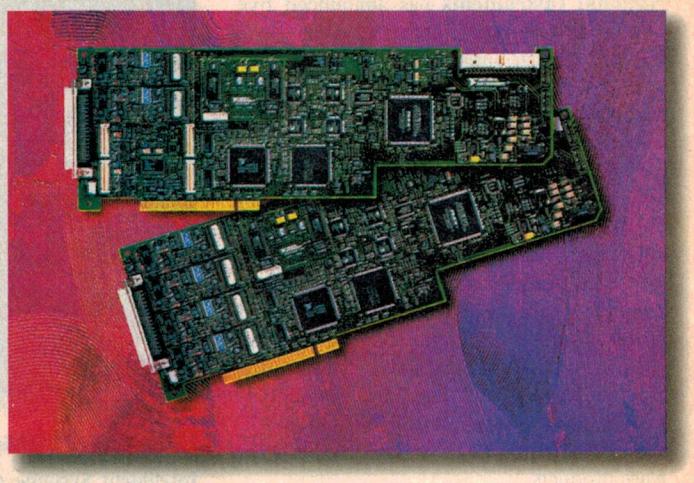
For more information circle **164** on the reader service card or contact Intelligent Systems Australia, PO Box 118, Berwick 3806.

5MS/s sampling PCI acquisition boards

National Instruments has announced two high-speed, simultaneous sampling multifunction data acquisition boards for PCI computers running Windows NT/95. The PCI-6110E and PCI-6111E plug-in data acquisition boards have a 12-bit analog-to-digital converter (ADC) on each of their four and two analog input channels, respectively, and can measure voltages up to +/-42V.

The boards are PCI bus masters and sustain 5MS/s per channel without burdening the CPU. They are claimed to be ideal for applications requiring high-speed simultaneous acquisition, such as vibration analysis, transient captures, phase measurements, spectral analysis, and electronics testing. Both are compatible with a wide variety of industry-standard application software including LabVIEW, LabWindows/CVI, ComponentWorks Measure, and VirtualBench.

The voltage input range is bipolar and software-configurable up to +/-42V. Software-programmable gains include 0.2, 0.5, 1, 2, 5, 10, 20, and 50. Both boards feature two 16-bit analog output channels, eight lines Of TTL-compatible digital I/O, and two up/down, 24-bit counter timers; all of which users can synchronisc for precision, timed acquisition and generation.



For more information, circle **165** on the reader service card or contact National Instruments Australia, PO Box 466, Ringwood 3134.

Sub-$200 print server

Intelligent Technologies has released the Intelligent Mini, claimed as the first print server to retail under $200 in the Australian market and a simple and efficient network printing solution for Windows 95/98 and Windows NT users.

The new server measures only 55 x 57 x 20mm and has been designed to provide printer access to all users across a network in a matter of minutes. The simple installation software and management tools provide minimal setup and operation effort.

The Intelligent Mini is a single, uni-directional parallel port print server with a printing speed of over 100K bytes per second. It simply connects to the back of the printer and only takes as much space as a cable connection. The RRP is $199.00 including tax.

For more information circle **166** on the reader service card or contact Intelligent Technologies, Level 5/99 Phillip Street, Parramatta 2150.

Converts printer into digital copier

Taiwan firm **Avision Inc** has announced ScanCopier, a colour scanner which can also transform an ordinary laser printer into an ultra high quality copying machine at very low cost.

ScanCopier's powerful DIALOGIC processor is claimed to intelligently enhance each scanned image to produce the best copying result. The blurred text in a mixed photo/text page is digitally processed to produce a result that is always sharp and clear.

ScanCopier comes with features that are not available in high priced copiers, such as Automatic Background Removal, Gamma Correction, Shading Correction, Digital Zooming from 25% to 400%, Auto-zooming etc. All these functions are implemented in hardware to ensure fastest processing speed. ScanCopier can sustain copying speed as fast as the printer's top printing speed. For example, the top copying speed when connected to Lexmark Optra S1650 printer is 16 pages per minute.

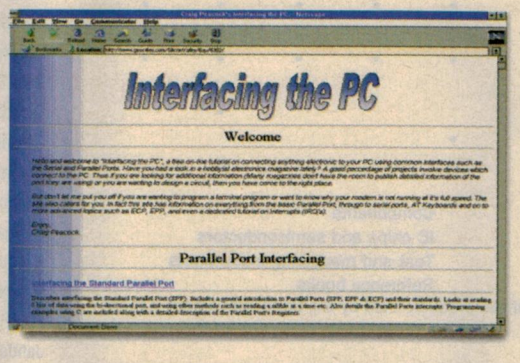
Installation is very simple: just plug in a cable to the laser printer's parallel port and ScanCopier is ready for operation. For copying purposes, ScanCopier does not need to be connected to PC and there is no need to run any software. The unit's control panel resembles a typical copy machine. Pressing a button causes ScanCopier to scan and print copy just as with a traditional copy machine. The unit has an RRP of $499.

For more information circle **167** on the reader service card or contact distributor InnoVision, 174 Corio Street, Shepparton 3630. ❖

Webwatch

by Graham Cattley

KNOW THE DIFFERENCE between EPP and ECP parallel ports? OK then, do you know how to talk to one with your latest circuit? Well, I didn't until Craig Peacock drew my attention to his site at **http://www.geocities.com/SiliconValley/Bay/8302**. Here Craig has presented a very comprehensive tutorial on how to interface with the PC, including pages on communicating with SPP, ECP and EPP ports, serial (RS-232) and even computer keyboards.



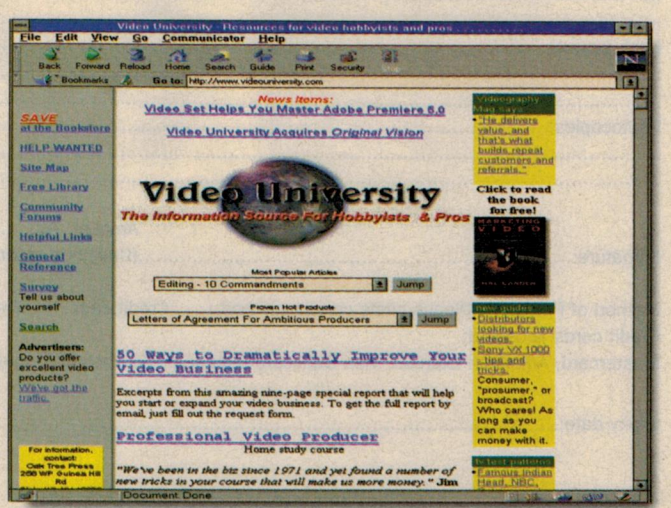
There are high quality schematics of interface circuits, waveform and timing diagrams, and software to download to help you with your port control problems. To top it all off, most of the info is available in PDF form as well. It is all well laid out, well explained and of great interest to anyone trying to interface to their PC. Top marks for one of the most informative and comprehensive sites of its kind.

TELSAT COMMUNICATIONS offer a fair amount of info on satellite television, with their web site at **http://www.telsat.com**. Full technical specs on all their products, including antennas, LNBs, receivers and decoders, along with FAQs and beginner's guides make this site more than the usual catalog-on-the-internet. If you are looking for satellite tracking software, connector pinouts, international TV programming schedules, or need to know the broadcasting system used in Peru, this is the place to be.

RIGHT — THAT'S IT. I can categorically say that I have never seen so many electronics related links in one place. Thanks to reader Ross Herbert, I can now tell you about Samuel M. Goldwasser's Bookmarks. An innocent sounding title for a page, but it's one that could well put Webwatch out of business. To even try and cover just the subject headings here would take up most of this column, and I gave up counting the number of links at 500 or so... The page itself contains nothing else, just a long sausage listing of URLs and a brief two or three word description of the site.

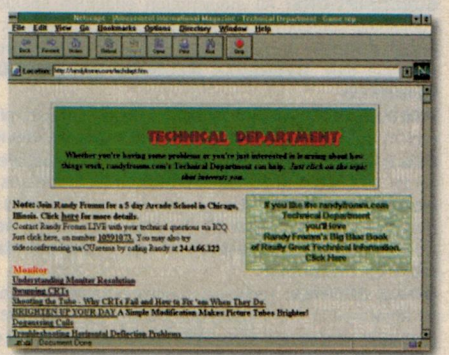
Oh, that's right, you want the URL, don't you? Try **http://www.repairfaq.org/~filipg/HTML/REPAIR/F_Repair_Links.html** on for size and see how you go.

THE VIDEO UNIVERSITY contains a large 'Free Library' of articles and guides on a diverse range of topics, mostly on the theme of recording and editing your own productions. Adjusting back focus, professional and consumer video formats, equipment reviews, info on copyrighting your productions are just some of the articles you'll find, along with VCR first aid and a 23 chapter 'book' on VCR repair. There's the odd humorous piece, and some articles quite unrelated to video or electronics, but it would be a good idea to look through this site at **http://www.videouniversity.com** if you are thinking of taking a more serious interest in professional video production.



RANDY FROMM is quite a character. His page at **http://randyfromm.com/techdept.htm** is the home of the Randyfromm.com Technical Department, and it contains such gems as 'Take a Triac and Call Me in the Morning', which is an article on understanding the thyristor family of solid-state switches. As you might have guessed, Randy takes a rather lighthearted approach to teaching, but to my mind, there is no better way.

There's a swag of articles on repairing monitors, fixing power supplies and game



equipment (including pinball machines) as well as a number of schematics for monitors. He explains how to build a curve tracer, how components fail, how to work with Plexiglas and relates the story of Phil the Filter Capacitor — which really explains the role of filter caps in the horizontal output of a video monitor. ❖

EA Directory of Suppliers

Which of our many advertisers are most likely to be able to sell you that special component, instrument, kit or tool? It's not always easy to decide, because they can't advertise all of their product lines each month. Also, some are wholesalers and don't sell to the public. The table below is published as a special service to EA readers, as a guide to the main products sold by our retail advertisers. For address information see the advertisements in this or other recent issues.

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KEY TO CODING

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B	Tools	E	IC chips and semiconductors
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Note that the above list is based on our understanding of the products sold by the firms concerned. If there are any errors or omissions, please let us know.

Electronics Australia Reader Services

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Notes & Errata

Video Enhancer & Stabiliser (November 1997): A small number of constructors have still encountered difficulty in achieving correct operation of the stabilising circuitry, apparently due to either faulty triggering of either U4 or U5 (one shots forming blanking pulses), or insufficient adjustment range for presets RV1 or RV2, even when R8 is increased to 47k. Presumably these problems are still due to component tolerance variations.

Reader and constructor Chris Nelson of Morphett Vale in SA suggests that where U5 is not triggering reliably, C12 may be increased in value to 470pF. To increase the adjustment range of RV1 and RV2 he has also increased these to 20k and 5k respectively, and reduced R10 to 1.5k. However these changes should only be made if necessary. ❖

LEDs, FLASHING LEDs & PHOTO TRANSISTORS

(NOTE: When buying LEDs that most STANDARD LEDs are only 1mC or less!!)

3mm

3000 mC - YELLOW..... 10 for $5
300 mC - GREEN..... 10 for $3
1400 mC - RED..... 10 for $6
Photo Transistor..... 10 for $5

5mm

3000 mC - YELLOW..... 10 for $6
300 mC - GREEN..... 10 for $4
3500 mC - RED..... 10 for $6
400 mC - BLUE..... 10 for $6
Photo Transistor..... 10 for $5

5mm FLASHING

3000 mC - YELLOW..... 10 for $10
60 mC - GREEN..... 10 for $10
300 mC - RED..... 10 for $10

10mm

3000 mC - YELLOW..... 10 for $12

10mm FLASHING

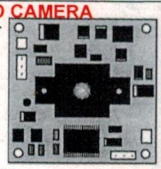
100 mC - GREEN..... 10 for $12
3000 mC - RED..... 10 for $12

******* MYSTERY BAG OF 100 LEDs *******

Contains: No standard LEDs!!!

All premium quality. or better with at least (if not more) 1blue, 1 ultra green and 1 flashing. An absolute steel at $8 per bag.

COLOUR MINI VIDEO CAMERA



Unlike most this colour cameras available has only 1 42mm X 42mm PCB, with high quality picture. 12v@100mA, composite video out just connect to video monitor or recorder $190

COLOUR & B / W DOME CAMERAS

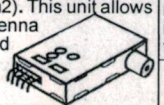
In a tough wall or ceiling mountable dome, same camera modules as on this page with internal universal swivel bracket Ideal for security installation Colour:$240 B / W:$150

PRE-BUILT MINI AMP FOR CAMERAS

20X21mm. Includes microphone, cable & connector, requires 12VDC $10

FREE VHF VIDEO MINI MODULATOR

With every camera. (Rm2). This unit allows you to use your Tv's antenna input & if you need sound just add $4 to the price of a camera for our VHF modulator sound kit



50X50X50mm CASE+SWIVEL MOUNT

strong adjustable universal bracket $4 Bracket only :$1.50 ideal for our cameras

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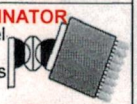
With strong universal swivel mount & 50X50X50mm housing:$36 For other sizes check our Web Site



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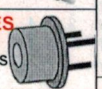

NEW STOCKS OF STEPPER MOTORS

30 oz./in. TORQUE, 2.5 DEG, 144 STEP, LOW VOLTAGE, COMPACT 57 X 38MM

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COMPUTER CONTROLLED STEPPER MOTOR KIT: can drive larger motors, has optoisolation. Inc. software and notes: $50 or $65 with two new 2.5 deg. motors!!

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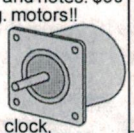

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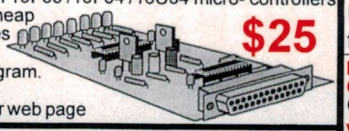

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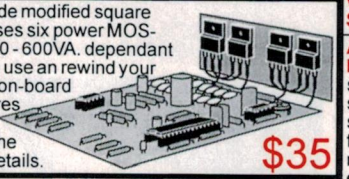
12VDC - 240AC INVERTER

Features include modified square wave output, Auto start with load sensing, Uses six power MOS-FETS with minimal heatsinking required. 200 - 600VA. dependant on trans former size. To save money you can use an rewind your own transformer. Basic kit includes pcb & all on-board components + 4 60A MOSFETS. $35 Requires 240V to 8-0-8 V transformer. Some surplus 200VA transformers may be available with the kit for a total of $60. Ring or E-Mail for more details.



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LASER DIODE POINTER KIT

Did you ever imagine you could buy a very bright! laser for just $15? well guess again!!!

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NEW 1/2/3 AXIS CNC SYSTEM.

(computer numerical control) This system includes a new stepper motor driver kit (one kit required for each axis) designed to be used with software freely available on the Internet for use with home or professionally built a milling machine, lathe, engraver or cutter etc. with home & limit switches and a high degree of accuracy (can be better than .001". We supply the kit inc. Pcb all on-board components etc. plus Internet resources shareware software & building or buying mechanical components. Around $30 per axis. Call for further details.

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*** NEW *** NEW *** NEW *** HIGH POWER IR TRANSMITTER AND RECEIVER

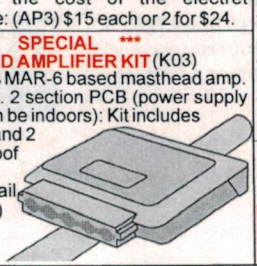
Applications include data transmitter, powerful Passive infrared de-tector, IR invisible fence / gate & doorway monitor. Range: with 5 IR LEDs (can drive up to 50 LEDs) passive mode 10m (5 LEDs), active mode 40m (5 LEDs). Range can be boosted with a cheap torch re-flector. The kit has active high & active low outputs for relays etc Simple to construct PCB can be cut into two for active mode or for data transmission. Kit inc. PCB, all on-board components, 5 IR LEDs + salvaged new plastic case All for $28

AMP - PREAMPLIFIER AND MORE! :

A professional mostly Surface Mount PCB that contains a 5W amp. based on a TDA1905 IC, & separate audio preamp section. We also provide a high quality unidirectional electret microphone, wind filter & microphone clip. A speaker & hook up info is also included. Appears to have been Designed for a communications system. Many applications including a two way intercom for motor bikes or rally that does not require switching ! Available at less than the cost of the electret microphone: (AP3) $15 each or 2 for $24.

*** SPECIAL *** MASTHEAD AMPLIFIER KIT (K03)

Our famous MAR-6 based masthead amp. Up to 2Ghz. 2 section PCB (power supply section. can be indoors): Kit includes Plugpack: and 2 Weatherproof boxes: $24. (MAR-6 avail. separately)



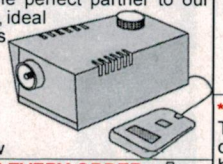
$24

NEW!!! CODE HOPPING UHF MINI TRANSMITTER / RECEIVER PAIR

High security in a very small transmitter and receiver (key-fob size) pre-built package. Both crystal locked on 433Mhz, with approx.100m range. The receiver will drive central locking systems, indicator relays, boot release relays, flashing lights and more:$100 for 1 TX & 1RX. extra Txs: $30. 12V- 12A relays:$2.50Ea.

FOG MACHINES

Professional quality fog machines. This unit would be the perfect partner to our laser light shows, ideal for discos, parties fashion parades etc. A special intro. price of under $200 Coming soon Reserve one now

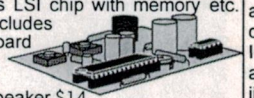


1$ VALVE WITH EVERY ORDER

Own a piece of Australian electronics history with this brand new 6J7 valve still in its original circa 1946 packaging for just $1 with every order. **$1**

20-30 SECOND DIGITAL SOUND RECORDER KIT.

This could be used as an answering machine at your front door or as a personal reminder device. Good quality sound Uses LSI chip with memory etc. built in. Kit includes PCB all on-board components, microphone, switches & speaker.$14



Series I 3 - 4 CHANNEL UHF RECEIVER:

Ref: EA Mar 94. Control up to 4 output relays. Uses a pre-built and pre-aligned UHF (304MHz) receiver module & security coding ICs. Output relays have 5A contact ratings and can be configured for toggling operation at each press of a Tx button or momentary operation when Tx button is pressed. 1 X 3ch transmitter plus 1 X4ch receiver:$50 extra Tx $15 is req. to access the fourth relay. 12V operation. (K39) $70

WIRED IR REPEATER KIT

Ref: EA March 96. Simple kit which uses a commercial IR Transmitter and a Receiver kit which works with most remote controls. The receiver uses a receiving module to pick up the 40KHz IR signal. The output of the receiver module is connected to the IR LED driving circuit of the IR Transmitter. This re-transmits, giving an extension in range of up to 15 metres: (K66R) $20

*** SPECIAL BARGAIN *** 12V/7Ah GEL BATTERY BARGAIN

Fresh stock of NEW standard battery $25

NOTE: please quote part numbers in brackets when ordering if available.

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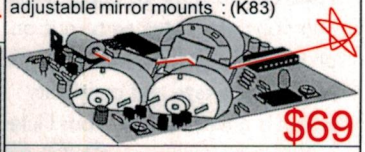
AUTOMATIC LASER LIGHT SHOW KIT: MKIII.

Automatically changes every 5 - 60 secs, & is adjustable. Each motor has 8 speeds, one motor is reversible, & one can stop. Countless great displays from single to multiple flowers, collapsing circles, rotating single and multiple ellipses, stars, etc. No more mirror & motor alignment hassles with motor mounting on the PCB and align with "Allen Key". Kit includes PCB, all on board components, three small DC motors, mirrors, precision adjustable mirror mounts : (K83)



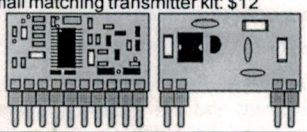
$69

SPECIALSPECIAL**SPECIAL** FOR $1 EXTRA WITH EACH ORDER WE WILL SEND WIRING KIT !!!

Great for cars, radios mobile phones, fog lights etc. 4 colours, 2 guages of wire, Spade connectors, fuse holders, fuses. 17+ mtrs. of wire. **Limited offer!!! just $1**

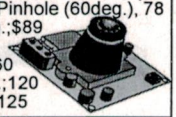
UHF DATA TRANSMISSION

Stamp sized Xtal locked 433.9MHz superhetrodyne receiver module $25 Small matching transmitter kit: $12



CCD CAMERA SPECIAL 32 & 40mm

The best "value for money" CCD camera on the market! 0.1 lux, High IR response & hi-res. Performs better than most cheaper models. **42mm** With: Pinhole (60deg.), 78 deg.; 92 deg.; 120 deg.;$89 or 150 deg: $104 **32mm** With: Pinhole (60 deg.), 78 deg.; 92 deg.;120 deg.;$110, 150 deg: $125

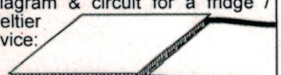


MINI PIR DETECTOR PCB MODULE

Professionally built 30mmX 34mm PIR module with an attached Freznel lens and cable with 4 pin connector Ideal for switching cameras, alarms etc. bargain priced at jist:$18 or 3 for $45

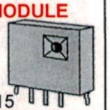
SOLID STATE 4-6A PELTIER EFFECT COOLER / HEATER

3.3A@14V PELTIER: $27, 6A @15VPeltier: $35, both are approx. 40X40X4mm, temperature controllable by reducing supply voltage /current, will even work from a 1.5V battery!! With data sheet, diagram & circuit for a fridge / heater. Peltier effect Device: 12Vfan (G02)



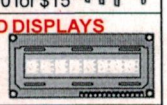
IR RECEIVER FRONT END MODULE

This device contains an IR receiver diode, an amplifier tuned to 38KHz, a bandpass filter, an AGC section & de-tector circuit. $2 Ea or 10 for $15



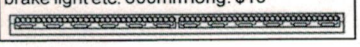
BRAND NEW STD LCD DISPLAYS

1 line x 16 char. : $16
2 line x 16 char. with LED back-light:$24



*** NEW DESIGN *** BRAKE LIGHT INDICATOR-60 LED KIT

This kit has two PCB's + current limit resistors + 60 LED's to make a very bright brake light etc. 600mm long: $15



Reader Info No 32

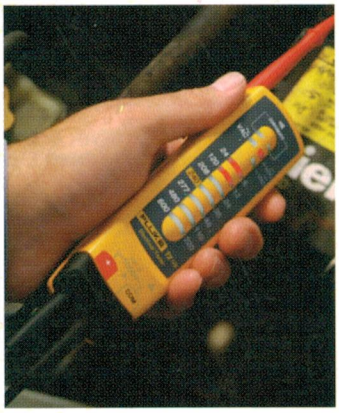
Where do you GO for the last word in electronics?

T2 Electrical Tester

There are no settings on this voltage and continuity tester. Simply probe a circuit to see whether you're looking at AC volts, DC volts, or an open circuit. You don't even have to turn it on or off! Designed to work long and hard, this voltage and continuity tester is a new release from Fluke.

Q 1627

FLUKE **$99**

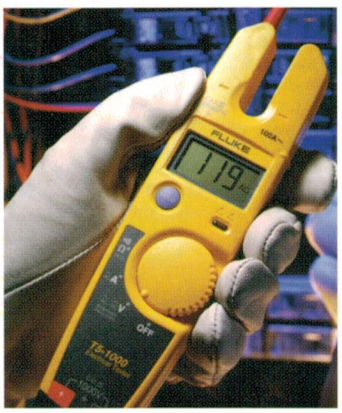


Three-in-one T5-600 Electrical Tester

The Fluke T5 Electrical Tester lets you check voltage, continuity and current with one compact tool. All you do is select volts, ohms or current and the tester does the rest. OpenJaw current lets you check current up to 100A without breaking the circuit.

Q 1628

FLUKE **$199**

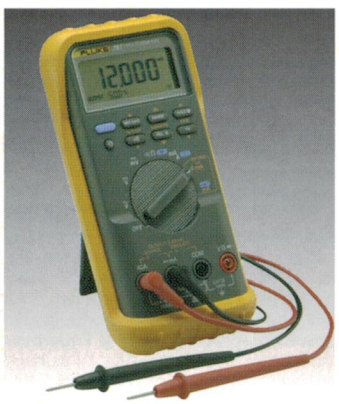


787 Digital Process Meter

Rugged and reliable, this latest version of the 80 Series Digital Multimeter is optimised for use on 20mA current loop systems. Features display backlight for lowlight conditions.

Q 1639

FLUKE **$1099***



NEW GENERATION OF AC/DC FLUKE CLAMPS

I-410 AC/DC Clamp Meter

With heavy duty construction for industrial use and troubleshooting forklifts, all-terrain vehicles and UPS. With shielded silicon rubber cable to withstand high-temperatures. 400A AC and DC current range.

Q 1649

FLUKE **$385*** **NEW**

I-1010 AC/DC Clamp Meter

Advanced performance, noise immunity and durability. Ideal for industrial use with shielding and filtering circuitry for use in electrically noisy environments. AC current range: 600A AC. DC current range: 1000A DC.

Q 1648

FLUKE **$659*** **NEW**

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